I. C. 6987 JANUARY 1938

UNITED STATES
DEPARTMENT OF THE INTERIOR
HAROLD L. ICKES, SECRETARY

BUREAU OF MINES
JOHN W. FINCH, DIRECTOR

INFORMATION CIRCULAR

GOLD MINING IN NEW MEXICO

BY

O. H. METZGER

AFTER THIS REPORT HAS SERVED YOUR PURPOSE AND IF YOU HAVE NO FURTHER NEED FOR IT, PLEASE RETURN IT TO THE BUREAU OF MINES, USING THE OFFICIAL MAILING LABEL ON THE INSIDE OF THE BACK COVER.

I.C. 6987,
January 1938.

INFORMATION CIRCULAR

DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

GOLD MINING IN NEW MEXICO[1]

By O. H. Metzger[2]

CONTENTS

Page

- Foreword 6
- Introduction 7
- Acknowledgments 7
- History 7
  - Gold production 8
- Economic and industrial features 12
- Topography 12
- Climate and plant life 13
- Mining districts 14
  - Mogollon and Cooney districts 14
    - Situation 14
    - Transportation and power facilities 14
    - History and production statistics 15
    - Topography 15
    - Geology 17
    - Water supply 18
    - Mogollon Consolidated Mines Co. 18
      - General 18
      - Geology 19
      - Development 19
      - Mining methods 20
        - Stoping 20
        - Tramming and hoisting 20
        - Sampling 21
        - Pumping 21
        - Ventilation 21
        - Labor 21
        - Costs 22

---

[1] The Bureau of Mines will welcome reprinting of this paper provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 6987."

[2] Associate mining engineer, Metal Mining Methods Section, Mining Division, Bureau of Mines, Tucson, Ariz.

CONTENTS - Continued

Page

Mining districts, continued.
Mogollon and Cooney districts, continued.
Mogollon Consolidated Mines Co., continued.

- Milling methods........................... 23
  - General........................... 23
  - Sorting........................... 23
  - Crushing........................... 23
  - Grinding........................... 23
  - Flotation........................... 24
  - Dewatering and filtering........... 25
  - Power........................... 25
  - Tailings disposal................. 25
  - Labor........................... 26
  - Costs........................... 27
- Freight and smelter costs................. 27
- Power house and compressor plant........ 28

Blackhawk Consolidated Mining Co. 28
- General.................................. 28
- Mining methods........................... 29
  - Stoping........................... 29
  - Drifting........................... 29
  - Haulage and hoisting............... 30
  - Labor........................... 30
  - Costs........................... 30
- Milling methods........................... 31
  - General........................... 31
  - Crushing........................... 31
  - Grinding........................... 31
  - Cyanidation........................... 32
  - Precipitation and melting.......... 32
  - Tailings disposal................. 32
  - Power........................... 33
  - Costs........................... 33
- Power house and compressor plant........ 33

Cooney Mining Co., Inc. 34
- Situation and general..................... 34
- Geology.................................. 35
- Development.............................. 35
- Mining methods........................... 36
  - Stoping........................... 36
  - Haulage........................... 36
  - Labor........................... 36
  - Compressor plant................. 36
- Milling methods........................... 36
  - General........................... 36
  - Crushing........................... 37
  - Grinding........................... 37
  - Cyanidation........................... 37
  - Precipitation..................... 37
- Power plant.............................. 37

CONTENTS - Continued

Page

Mining districts, continued.
  Mogollon and Cooney districts, continued.
    Idle mines.................................. 38
      Bearup.................................. 38
      Maud S.................................. 38
      Deep Down.................................. 39
      Confidence.................................. 39
      Cooney.................................. 39
      Gold Dust.................................. 40
      Ann Arbor.................................. 40
      Alberta.................................. 41
      Golden Eagle.................................. 41
      Trilby.................................. 41
  Hillsboro district.................................. 41
    Situation.................................. 41
    Facilities.................................. 41
    Climate and vegetation.................................. 42
    Topography.................................. 42
    Geology.................................. 42
    History.................................. 44
    Production.................................. 44
    Lode mines.................................. 45
      General.................................. 45
      Wicks mine.................................. 45
      Bonanza mine.................................. 46
        Situation.................................. 46
        History.................................. 46
        Geology.................................. 46
        Development.................................. 47
        Costs.................................. 47
        Equipment.................................. 47
    Placer mines.................................. 47
      General.................................. 47
      John V. Hallett Construction Co. 47
  Shandon or Pittsburg district.................................. 49
    Situation.................................. 49
    Topography.................................. 49
    Geology.................................. 49
    History.................................. 50
    Warnick Exploration, Ltd. 50
      Situation and general.................................. 50
      Mining methods and costs.................................. 50
      Labor.................................. 51

6082

CONTENTS - Continued

Page

Mining districts, continued.

Pinos Altos district.............................. 51
    Situation.................................. 51
    Geology.................................... 52
    General mining practice.................... 52
    Hazard mine................................ 52
    Golden Rule mine........................... 53
Steeple Rock district............................. 53
    Situation and facilities................... 53
    East Camp group of claims.................. 53
    Production................................. 53
Burro Mountain district........................... 54
    Situation.................................. 54
    Production................................. 54
Mt. Baldy district................................ 54
    Situation and facilities................... 54
    Water supply............................... 54
    Geology.................................... 54
    History.................................... 55
    Production................................. 56
    Aztec mine................................. 56
        Recent history......................... 56
        Present activities..................... 57
    Montezuma mine............................. 57
    Rebel Chief mine........................... 57
    Red Bandana mine........................... 57
    Ajax mine.................................. 57
    Placer mines............................... 58
Lincoln County.................................... 58
    Situation and facilities................... 58
    History.................................... 58
    Jicarilla district......................... 59
    Nogal district............................. 59
    White Oaks district........................ 60
Socorro County.................................... 60
    Production................................. 60
    Magdalena district......................... 60
    Silver Hills district...................... 60
    San Mateo Mountains........................ 60
    Rosedale Gold Mines, Ltd. 61

CONTENTS - Continued

Page

Mining districts, continued.
Socorro County, continued.
Rosedale Gold Mines, Ltd., continued.

Situation.............................. 61
History.............................. 61
Topography and geology................ 61
Development.......................... 63
Prospecting.......................... 63
Mining methods....................... 63
Milling.............................. 65
Power plant.......................... 67
Shops................................ 67
Housing.............................. 67
Costs................................ 67
Otero County................................ 68
Santa Fe County............................. 68
Gold production of base metal mines.............. 68
General..................................... 68
Tererro district............................ 68
Pecos mine of American Metal Co. 68
Situation and general................ 68
Geology.............................. 69
Development.......................... 69
Mining methods....................... 69
Milling.............................. 70
Lordsburg district.......................... 70
Situation and facilities.................... 70
Production.................................. 71
Eighty-Five mine............................ 71
Geology.............................. 71
Mining methods....................... 71

ILLUSTRATIONS

Figure | Following Page

1. Map of New Mexico showing gold-producing areas and districts...................... 8
2. Gold, silver, copper, lead, and zinc production of New Mexico from 1900 to 1935.................................. 10
3. Longitudinal projection of the Last Chance and Deadwood mines, Mogollon, N. Mex. 18
4. Flow sheet of Mogollon Consolidated mill 22

ILLUSTRATIONS - Continued

Figure		Following Page
5.	Ore bins and sorting floor of the Mogollon Consolidated Mines Co., Mogollon, N. Mex.	22
6.	Sketch showing arrangement of dams, abutments, and launders of the tailings pond of the Mogollon Consolidated Mines Co., Mogollon, N. Mex. ..	24
7.	Plan and longitudinal projection of the Little Fanney mine, Mogollon, N. Mex.	28
8.	Flow sheet of the Little Fanney mill of the Black Hawk Consolidated Mining Co.	30
9.	Flow sheet of mill of the Cooney Mining Co.	36
10.	Flow sheet of the Hallett Construction Co.	48
11.	Flow sheet of the Rosedale mill.......	64

FOREWORD

This is one of a series of circulars dealing with mining and milling operations in different mining districts in the Western States. Data on operating costs, grades of ore treated, wage scales, and haulage rates and other information on mining properties are obtained from the operators and other local sources during the course of field inspections. They are believed to be substantially correct as to conditions at the time the properties were visited but may not be in accord with facts established by later developments.

Chas. F. Jackson,
Chief Engineer,
Mining Division.

INTRODUCTION

This is one of a series of papers being published by the Bureau of Mines on gold mining in the Western States. It describes the production of gold in the principal mining districts of New Mexico. The material was gathered on a trip through the State in the summer of 1936.

ACKNOWLEDGMENTS

The author acknowledges the aid and cooperation of mine operators in all parts of the State, who willingly contributed all information requested. Geological reports of the Geological Survey and the New Mexico Bureau of Mines were drawn upon freely for information; credit to individual papers is given in the text.

HISTORY

The first white men to set foot on the territory which is now New Mexico were members of expeditions sent out by the Spanish governors of Mexico for purposes of exploration. As early as 1541, advance parties of Coronado's main expedition penetrated as far north as what is now Sierra County. Other expeditions entered the territory in 1581, 1582 and 1583; in 1605 the Province of New Mexico and town of Santa Fe were founded.

Most of the early explorers who entered this part of the Southwest journeyed up the Rio Grande River in their search for gold, silver, and precious stones. They found the country thickly inhabited by the Pueblo and kindred tribes of Indians, who, being an agricultural people, resisted the attempts of the Spaniards to develop the mineral resources of the region. Some prospecting, however, was done by the Indians under the supervision of the Jesuit Fathers and professional Spanish miners and prospectors. There were early attempts at working silver deposits, and small amounts of gold were recovered from placers. Turquoise was mined in a few places but the output was of little or no commercial importance.

In 1680 the Pueblo Indians revolted against the oppressive rule of the whites, and the Spaniards were compelled to leave the country. They were permitted to return 20 years later with the stipulation that they would never again engage in mining. Prospecting and mining ceased almost entirely until the end of the 18th century, when the copper deposits of Santa Rita were discovered. These deposits, however, were relatively unimportant until recently, when adequate transportation and smelting facilities made possible their development on a large scale.

New Mexico became a Territory of the United States at the end of the war with Mexico in 1848. The construction of the Southern Pacific and the Santa Fe and Atchison and Topeka Railroads in 1879-83 resulted in great activity and expansion. Professional miners and prospectors combed the Western States in their search for gold and silver. Many of the soldiers detailed to guard the railroad construction gangs and the overland stage routes spent much of their leisure time in prospecting and discovered some important deposits. During the last 25 years of the nineteenth century practically all of the important gold and silver districts of New Mexico were discovered and developed.

The early miners confined their attention almost entirely to gold and silver, because high freight rates as well as lack of reduction facilities made it impossible to produce base metals at a profit. In 1901 the El Paso smelter was acquired by the American Smelting and Refining Co. and was enlarged to treat copper and lead ores, as a result of which interest in mining was revived and many of the old gold and silver mines, which contained appreciable quantities of base metals, were reopened.

GOLD PRODUCTION

The first known records of gold production in New Mexico date from the time the Spaniards entered the territory in 1541. Gold mining as an industry, however, was unimportant until about 1880. Table 1 shows the annual production of gold, silver, copper, lead, and zinc from 1904 to the end of 1936. Figure 1 shows the areas and districts that have accounted for practically the entire production of gold in recent years.

Until the beginning of the twentieth century, gold was by far the most important metal produced in the State. With the enlarging of the smelter at El Paso, Tex., to treat lead and copper ores and the building of a zinc smelter at Amarillo, Tex., to treat zinc ores, gold ceased to be the most important metal. Gold production increased steadily until 1916, but it was surpassed in value by the base metals early in the century. In 1915, the peak of gold production, the value of copper, lead, and zinc was nearly five times that of gold and silver combined and more than ten times that of gold alone.

In 1914, 1915, 1916, and 1917 gold production exceeded $1,000,000 annually. From 1917 to 1918 production fell from $1,064,158 to $682,791, owing to the curtailment of production in many of the gold-mining camps of the State when gold could not be produced at a profit with the high operating costs brought about by the World War. A steady decline in production took place from 1918 to 1921, when the low point for the century, $196,822, was reached. This decline was due in part to continued curtailment of production in the gold-mining districts and in part to the slackening in production of base-metal ores containing gold. Another period of industrial expansion and higher prices, beginning in 1922, brought about a steady increase in the production of base metals and a consequent increase in gold produced from base metal ores, which persisted until 1929. Although gold production did not show a constant increase during that period, the general trend was upward and the peak was reached in 1929, coinciding with the peak in base-metal production. From 1929 to 1932 production of base metals again declined, with a corresponding decline in gold production.

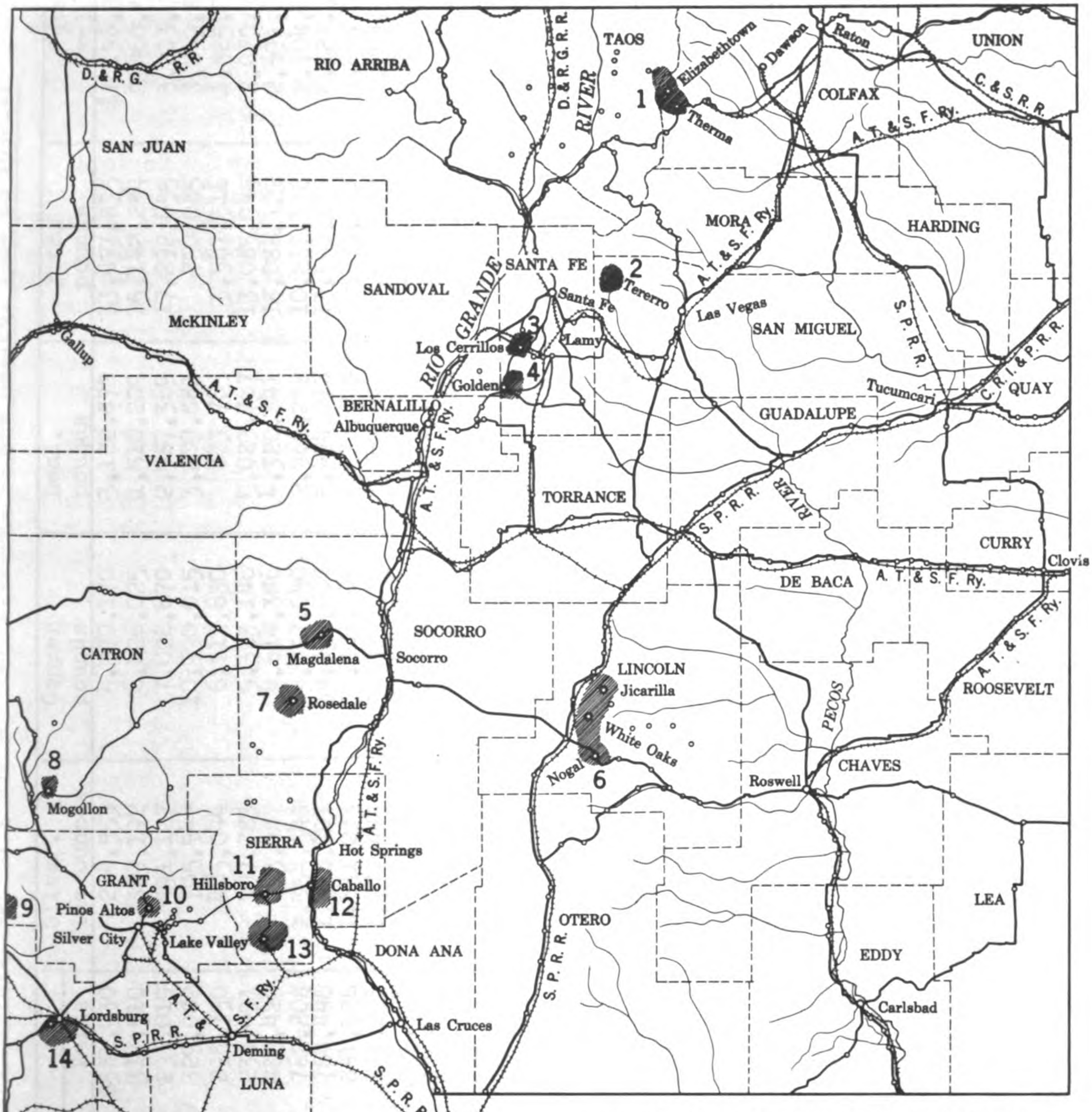


Figure 1.—Map of New Mexico showing gold-mining districts: 1, Elizabethtown, Mt. Baldy, and Therma; 2, Tererro; 3, Los Cerrillos; 4, Golden; 5, Magdalena or Kelley; 6, Jicarilla, White Oaks, and Nogal; 7, Rosedale; 8, Mogollon; 9, Steeple Rock; 10, Pinos Altos; 11, Hillsboro; 12, Pittsburg Channing; 13, Lake Valley; 14, Pyramid.

TABLE 1. - Gold, silver, copper, lead, and zinc produced in New Mexico, 1904 to 1936.[1]

Year	Gold		Silver, fine ounces	Copper pounds	Lead, pounds	Zinc, pounds	Total value
	Fine ounces	Value					
1904	18,478	$381,930	214,553	4,970,170	3,122,872	13,493,835	$1,196,390
1905	15,361	317,510	369,192	6,126,025	1,510,209	15,142,254	2,460,535
1906	14,176	293,019	491,127	7,028,670	2,987,369	17,292,655	3,203,739
1907	15,965	329,982	705,544	10,990,015	3,809,881	750,085	3,239,823
1908	14,454	298,750	405,044	6,112,630	873,763	3,567,516	1,525,091
1909	11,587	239,491	397,783	5,393,146	5,029,767	13,085,945	2,070,368
1910	23,340	482,424	843,987	4,614,386	4,320,841	18,088,129	2,691,080
1911	36,905	762,808	1,354,540	4,057,040	2,966,222	10,237,176	2,704,843
1912	37,951	784,446	1,536,701	34,030,964	5,494,018	13,566,637	8,527,955
1913	42,668	881,926	1,631,273	56,308,706	3,946,304	16,523,161	11,694,002
1914	56,687	1,171,696	1,777,445	59,307,925	1,763,641	18,403,392	11,049,932
1915	70,688	1,461,105	2,005,531	76,788,366	4,542,361	25,404,064	19,279,468
1916	66,884	1,382,480	1,766,274	92,747,289	8,214,189	36,570,649	30,827,767
1917	51,484	1,064,158	1,394,365	105,568,000	8,108,804	30,200,000	34,896,936
1918	33,033	682,791	782,421	98,264,563	8,398,239	24,050,324	28,521,413
1919	31,721	655,656	837,418	51,150,541	2,886,513	7,594,644	11,814,958
1920	23,237	480,302	768,042	54,400,691	2,869,525	10,013,580	12,367,857
1921	9,521	196,822	571,899	14,267,338	678,601	228,000	2,651,145
1922	19,964	412,693	752,240	31,937,207	3,012,223	4,496,806	5,898,446
1923	26,689	551,713	747,127	61,356,802	3,823,427	16,496,000	11,573,805
1924	24,803	512,735	795,070	74,691,436	3,634,511	20,759,200	12,470,119
1925	26,561	594,073	735,124	76,427,825	6,420,060	18,492,300	13,875,960
1926	19,630	405,803	450,934	81,642,379	6,960,366	24,104,800	14,481,808
1927	29,241	604,483	890,083	74,251,863	16,052,855	59,603,000	15,662,076
1928	32,912	680,360	827,793	89,854,646	15,610,501	62,406,000	18,815,863
1929	35,176	727,162	1,121,546	97,717,262	22,260,811	68,910,000	24,473,675
1930	32,370	669,156	1,107,335	65,150,000	20,756,900	65,529,000	13,748,217
1931	31,165	644,160	1,041,859	61,503,100	22,537,000	55,732,000	9,494,766
1932	23,208	479,753	1,142,351	28,419,000	20,227,000	51,186,000	4,734,683
1933	26,474	675,678	1,181,580	26,947,000	22,086,000	61,848,000	6,229,637
1934	27,307	954,380	1,061,775	23,630,000	18,729,000	53,043,000	6,505,002
1935	33,435	1,170,225	1,061,902	4,505,000	14,578,000	44,252,000	4,837,590
1936	33,298	1,165,430	1,141,000	6,618,000	14,307,000	41,551,000	5,346,977
Total	996,373	22,115,100	31,910,858	1,496,777,985	282,518,773	922,621,152	358,871,926

[1] Mineral Resources of the United States and Minerals Yearbook.

The parallelism of the curves for gold production and base-metal production (see fig. 2) from 1917 to 1933 is due to the fact that during that period from 75 to 90 percent of the total gold was produced from complex ores containing copper, lead, zinc, gold, and silver that were mined principally for their base-metal content. In 1930, due to unemployment in other lines, many men took to prospecting and working placer deposits. Production from this source has been very small but showed a constant increase from 1930 to 1936.

In September 1933, producers of domestic gold gained the advantage of a world price of about $30 per ounce, and early in 1934 the price per ounce was fixed at $35. Interest in gold mining was revived, and many of the mines in the gold-producing areas that had been idle since 1917 and 1918 were reopened and operated. The Mogollon and Cooney districts in Catron County and the Hillsboro and Pittsburg districts in Sierra County have accounted for most of the increase in production. From 1932 to 1936, the gold-production curve showed a constant increase, whereas the base-metal curves showed a constant decrease.

Table 2 shows production of gold by counties from 1929 to 1935, inclusive, and table 3 shows production according to ore classification from 1929 to 1936. The following table shows the gold, silver, and copper content of ore from Hidalgo County and Lordsburg in terms of recovered values, 1929-32, inclusive.

	Gold		Silver		Copper 1/	
Year	Oz. per ton	Value	Oz. per ton	Value	Percent	Value
1929	0.118	$2.36	1.83	$0.98	2.3	$7.03
1930	.138	2.76	1.85	.71	2.3	6.03
1931	.121	2.42	1.44	.42	2.1	3.77
1932	.088	1.76	2.23	.63	2.6	3.28

1/ Value of copper content based on market price of copper.

In 1931 and 1932, a major portion of the ore from the Lordsburg area was classed as gold-silver ore, although the ratio of gold and silver to copper was practically the same in those years as formerly. The change in classification was due to the fall in the price of copper, which made the copper content of the ore less valuable than the gold-silver content.

Gold production of the State from gold ores, gold-silver ores, and placers shows a constant increase from 1929 to 1936, and the production from lead, zinc, and copper ores shows a nearly constant decrease. In 1935 approximately 47 percent of the total production was from ores of the first class and 53 percent was from base-metal ores.

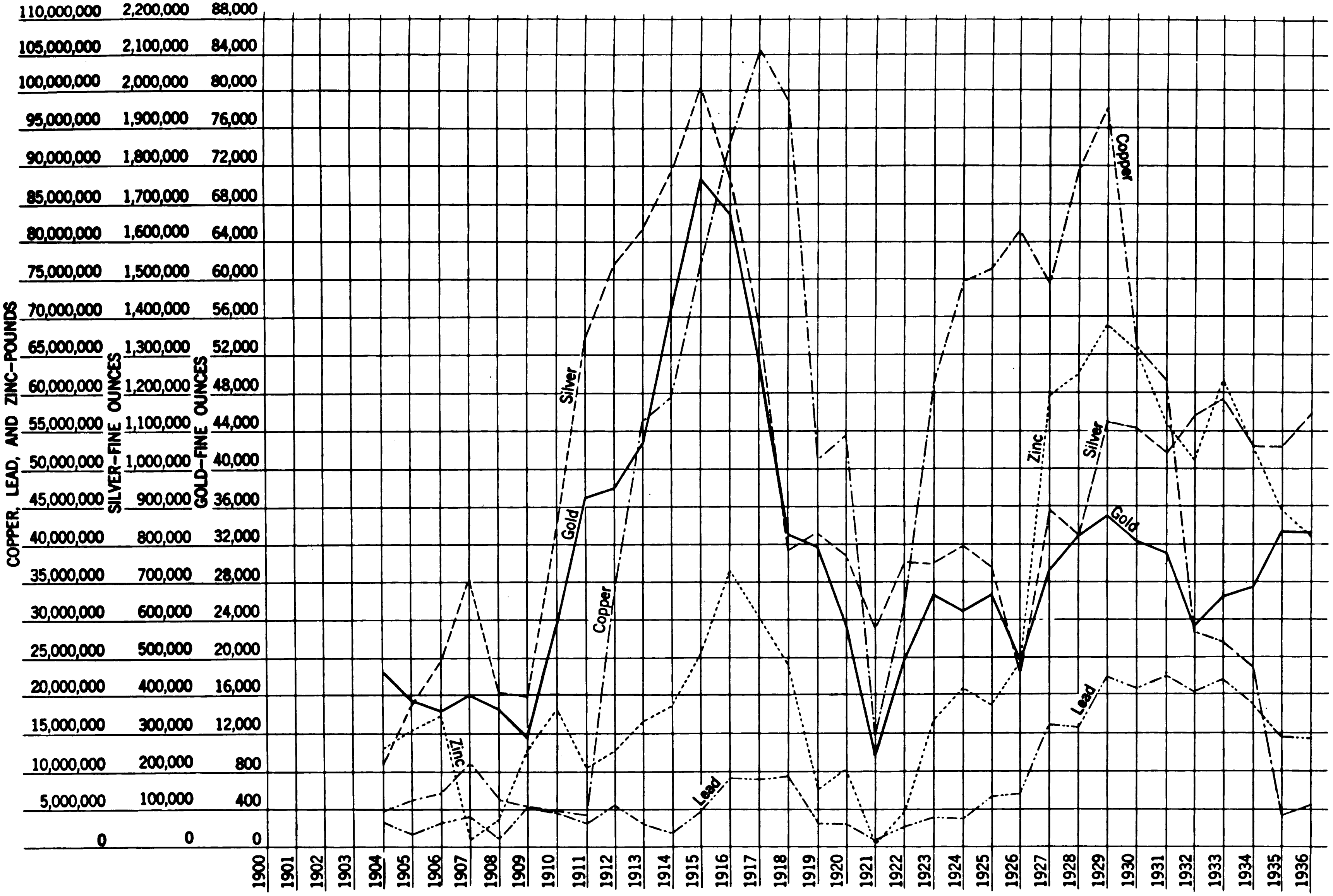


Figure 2.—Gold, silver, copper, lead, and zinc production in New Mexico from 1900 to 1936.

TABLE 2. - New Mexico gold production, in fine ounces, by Counties from 1929 to 1935[1]

	1929	1930	1931	1932	1933	1934	1935
atron	738.80	931.40	733.35	3,211.05	2,651.77	3,198.57	6,946.17
olfax		12.00	40.05	233.08	347.14	1,146.51	2,316.88
ona Ana		150.40	23.00	0.30	9.48	8.04	-
rant	6,543.20	3,832.30	3,655.85	2,201.45	1,792.00	3,049.07	2,836.43
uadalupe	-	-	-	-	-	-	-
idalgo	10,608.40	14,012.65	11,278.00	1,412.00	111.12	675.33	992.86
incoln	1.21	6.23	43.40	478.15	703.47	1,041.66	893.40
una	12.00	14.80	-	1.30	.29	.92	6.20
tero	355.95	19.57	48.33	142.10	197.42	129.93	258.69
io Arriba	-	-	-	19.90	11.95	15.11	9.91
andoval	.92	-	-	364.25	158.83	110.47	20.20
an Miguel	16,578.20	13,102.35	14,924.55	13,941.20	19,424.69	15,632.39	14,816.66
anta Fe	148.07	75.40	106.65	188.75	338.98	234.42	201.00
ierra	139.33	175.80	322.50	898.95	716.53	1,894.62	3,578.63
ocorro	14.00	5.40	-	77.65	6.92	161.00	550.89
aos	-	-	9.00	14.00	8.71	8.87	7.08
orrance	-	-	-	-	.29	-	-
alencia	-	-	-	-	-	-	-

[1] Mineral Resources and Minerals Yearbooks, 1929 to 1935.

TABLE 3. - Gold production in New Mexico from 1929 to 1936 showing production according to ore classification.[1]

Year	From gold ores, gold-silver ores, and placers (fine ounces)	From lead zinc and copper ores (fine ounces)	Total (fine ounces)
1929	1,057.31	34,119.15	35,176.46
1930	1,941.54	30,428.88	32,370.42
1931	11,767.43	19,393.81	31,161.24
1932	6,488.08	16,722.97	23,208.05
1933	5,891.91	20,582.18	26,474.09
1934	8,600.65	18,706.36	27,307.01
1935	17,913.03	15,521.97	33,435.00
1936	19,697.06	13,339.94	33,037.00

[1] Mineral Resources and Minerals Yearbooks, 1930 to 1937.

ECONOMIC AND INDUSTRIAL FEATURES

New Mexico (fig. 1) has an average length from north to south of about 360 miles and an average width from east to west of about 340 miles, the area being 122,503 square miles. The population was 423,317 in 1930. Albuquerque, Santa Fe, and Roswell are the three largest towns, with populations in 1930 of 26,570, 11,176, and 11,173, respectively.

Two transcontinental railroads cross the State from east to west - the Southern Pacific system in the southern part and the Atchison, Topeka, and Santa Fe system in the northern part. One branch line of the Santa Fe runs down the Rio Grande valley from Albuquerque to El Paso and another from Clovis south through Carlsbad to Pecos, Tex. Spurs from the two systems serve many of the more important coal and metal mining centers such as Silver City, Santa Rita, and Dawson.

Agriculture, stock raising, coal mining, and metal mining are the principal industries. In recent years a number of producing oil wells were brought in in the northwestern part of the State, but oil production has not yet developed into a major industry.

The mineral resources of the State are large. The coal fields of Gallup are among the most productive in the west and for many years have supplied fuel for most of the railroads and smelters of the southwest. The manganese deposits at Silver City and the iron deposits at Fierro have been, until recently, the important sources of supply of manganese and iron ores for the iron smelter at Pueblo, Colo. Although many of her lead and zinc mines have been closed since 1931, New Mexico has maintained a position of prominence in lead and zinc production throughout the years of general industrial inactivity. The Chino open-pit copper mine at Santa Rita is among the largest producers of copper in the United States. Besides this, considerable copper is produced from the complex ores from the mines of Hanover, Pecos, and Lordsburg. One of the three largest known molybdenum deposits in the world is near Questa. This deposit is of much higher grade than other deposits in the United States and has been in production for a number of years.

TOPOGRAPHY

The characteristic physical feature of New Mexico is the main branch of the Rocky Mountain range running north and south through the State. The Sangua de Cristo and the San Juan ranges of southern Colorado nearly converge in the north central part of the State, the Sangua de Cristo range forming the east and the San Juan range the west watershed of the Rio Grande River valley.

In the vicinity of Santa Fe the mountains diverge. One branch bears southwest forming the San Mateo and Cebolleto mountains just east of Gallup and terminates in the Mogollon mountains and the Black Range in the southwestern part. The other branch bears due south, forming the east watershed of the Rio Grande River and terminating in the Sacramento Mountains and the Guadalupe Mountains near the Texas border.

The Rio Grande River flows from north to south throughout the length of the State between these two ranges. At the Colorado border, the elevation is about 7,500 feet, and at El Paso, where it flows out of the State, forming the boundary between Texas and Mexico, the elevation is 3,762 feet.

The Continental Divide roughly parallels the west range. For the most part, it is to the west of the crest of the range and in many places it is in comparatively flat country. For several hundred miles in the northern part of the State it is only from 5,000 to 6,000 feet above sea level, and near Lordsburg, in the southern part of the State, it is only 4,200 feet above sea level. The only place in the State where it forms the crest of a mountain range is in the Black Mountains just east of the Mogollon Mountains.

The eastern part of the State is comparatively level, with no important mountains. The Pecos River, with headwaters just east of Santa Fe, flows south through the eastern and southeastern part of the State into Texas. The Canadian and North Canadian Rivers drain the northwestern part of the State and flow east into Texas.

The lowest point in the State is in the southeastern corner on the Pecos River, 3,000 feet above sea level. There are several peaks from 11,000 to 12,000 feet above sea level, but only one over 13,000 feet. Much of the mountainous country north of Santa Fe is from 7,000 to 8,000 feet above sea level, and small areas in the Mogollon and Black Mountains are above 7,500 feet; the rest of the State, with the exception of the mountains east of the Rio Grande River, is comparatively low and level.

CLIMATE AND PLANT LIFE

With the possible exception of California, New Mexico has the most varied climate in the United States. This is due to the fact that the highest country is in the northern and the lowest in the southern part of the State.

Near the Colorado State line, where altitudes over 10,000 feet above sea level are common, the snow fall is heavy and the summers are short and cool. Many of the high peaks of this region are above timberline. The annual precipitation is sufficient to sustain profuse growth of evergreens and aspens. At altitudes over 10,000 feet the Engleman spruce and the Colorado blue spruce are the most common evergreens while aspen is the most common of the deciduous trees. At altitudes below 10,000 feet the Douglas fir, and the Pondorosa or western yellow pine are more common. At the more moderate altitudes of 5,000 to 8,000 feet, the piñon and juniper are the most common species, while in the low lands below 5,000 feet the only native plant life is mesquite, cactus, yucca and other desert varieties, except along streams, where cottonwood, willows, birch, and sycamore are common.

In sharp contrast to the Alpine climate of the mountainous region of the northern part of the State is that of the agricultural regions in the southern part of the State along the Rio Grande valley. Here it seldom, if ever, snows, and severe frosts are not common. Many cultivated varieties of fruit are common, and even citrus fruits can be grown in some localities.

MINING DISTRICTS

MOGOLLON AND COONEY DISTRICTS

Situation

The Mogollon mining district is in the western part of Catron County, N. Mex., about 15 miles east of the New Mexico-Arizona State line. Mogollon, with a population of 300, is the largest settlement in the district; it is situated in the center of the greatest mining activity. The village of Glenwood, with a population of 100, is about 10 miles by road west of Mogollon on the main highway from Silver City. Alma, with a population of 128, is about 5 miles north of Glenwood, near the main highway from Silver City to Alpine. At one time it was the largest settlement in the district, but owing to Indian troubles in the early days and changing economic conditions, the population shifted to other centers.

Stock raising is carried on quite extensively in the adjacent regions, and considerable farming has been made possible around Glenwood and Alma by irrigation with water from the San Francisco River.

Transportation and Power Facilities

Silver City is the nearest railroad station, 47 miles from Glenwood and 57 miles from Mogollon. An improved road from Alma to Cooney Canon serves the mines in the northern part of the district. The road from Glenwood to Silver City and that from Glenwood to Mogollon are graveled and in good condition, the latter having been improved recently by workers of the Civilian Conservation Corps. The Cooney Canon road has not been improved for a great many years and is impassable during a considerable part of the summer rainy season.

Ore and concentrate shipments usually are made to the smelter at El Paso, Tex. Occasional shipments are made to Douglas, Ariz. Silver City, through which nearly all rail shipments are handled, is 175 miles by rail from El Paso and 225 miles by rail from Douglas.

Trucking rates to Silver City are 20 cents per hundredweight for concentrates and 30 cents per hundredweight for back freight. The freight rate from Silver City to El Paso is $1.15 a ton on minimum cars of 25 tons, with no sliding scale.

There are no power facilities in the district. All of the mines generate their own power with Diesel or gasoline generating plants. Fuel oil costs around 6-1/2 cents a gallon in Mogollon. The cost of generating current is about 1.5 cents per kilowatt-hour at the larger plants.

History and Production Statistics[3]

The first discoveries in the district were made by Sergeant Cooney of the Eighth U. S. Cavalry, who observed the prominent vein outcrops while making scouting expeditions into the region. In the fall of 1875, when his enlistment expired, he went back into the district and located claims that were later developed into the Cooney mine.

The first ore was shipped in 1879, but in 1880 the valley settlements were nearly wiped out by an attack by Victorio and his Apaches, and Cooney was killed while assisting in the defense of the settlement of Alma. With the repulse of Geronimo and his raiders in 1885 the Indians ceased to be a menace and mining development progressed rapidly.

It has been estimated that prior to 1905 the production was about $5,000,000 in gold, silver, and copper. The first veins developed were those that outcrop in the valley of Mineral Creek; efforts were first confined to rich oxidized pockets near the surface. Later on, ore shoots were developed and mined in the lower silver-bearing sulphide zone in the Maud S and the Deep Down mines in the canyon of Silver Creek below Mogollon. The development of the cyanide process aided greatly in the exploitation of the low-grade ore bodies. As the richer surface ores became exhausted, many of the smaller properties were consolidated. Today the major portion of the producing properties of the district are owned, leased, or held under option by the Mogollon Consolidated Mines Co., and the Black Hawk Consolidated Mining Co.

Table 4 shows the production of the Mogollon district in gold, silver, copper, and lead from 1904 until 1935.

Topography

The elevation of the San Francisco River valley at Alma is about 4,900 feet. Between the river valley and the Mogollon Mountains is a series of flat-topped mesas ranging in elevation from 5,400 to 6,000 feet. Just east of these mesas the Mogollon Mountains rise steeply to an elevation of 7,500 feet. Deep box canyons have been cut in these mountains by all the principal streams.

---

[3] Ferguson, Henry G., Geology and Ore Deposits of the Mogollon Mining District, New Mexico: Geol. Survey Bull. 787, 1927.

TABLE 4. - Gold and silver production of the Mogollon District, New Mexico, 1904 to 1935.[1]

Year	Ore, tons	Gold	Silver, fine ounces	Copper, pounds	Lead, pounds	Total value
1904	11,276	$ 61,880	79,014	422,308	—	$162,484
1905	15,534	97,158	240,934	295,175	—	288,735
1906	16,075	127,907	268,576	—	—	307,847
1907	20,698	105,431	418,338	150,000	—	411,516
1908	19,546	116,418	278,939	—	—	264,256
1909	23,945	111,464	249,413	46	49	241,167
1910	50,515	304,210	595,669	—	—	625,871
1911	102,219	531,358	1,067,038	1,873	1,862	1,097,206
1912	101,361	524,858	1,093,158	184	386	1,197,197
1913	115,739	619,886	1,306,766	4,418	1,217	1,409,912
1914	136,124	629,102	1,410,327	—	590	1,409,035
1915	119,716	509,165	1,301,059	—	2,426	1,168,916
1916	118,257	373,068	1,008,483	858	3,232	1,037,084
1917	111,934	258,620	722,642	414	1,593	854,327
1918	56,540	119,710	302,902	235	283	422,690
1919	56,531	148,136	382,800	9,521	—	578,643
1920	41,895	125,631	329,489	582	2,050	485,045
1921	48,870	126,791	310,774	—	—	436,565
1922	48,106	142,123	322,460	—	—	464,593
1923	47,644	179,351	398,714	—	—	506,296
1924	72,736	230,960	618,094	—	—	645,083
1925	51,118	163,522	449,659	—	—	475,613
1926	976	12,444	28,404	24,400	—	33,584
1927	89	4,678	3,591	—	—	6,714
1928	81	4,189	16,800	17,000	—	16,465
1929	438	15,287	40,437	15,187	—	39,513
1930	6,554	19,270	61,621	2,400	1,000	43,356
1931	6,274	14,967	38,800	1,100	—	26,319
1932	25,228	66,441	136,869	1,000	1,400	105,113
1933	32,914	54,817	126,020	3,000	1,400	99,131
1934	41,736	111,790	121,357	4,300	1,000	190,624
1935	59,637	243,116	274,172	1,000	1,000	440,300
Total	1,560,306	6,153,748	14,003,319	955,001	17,667	15,491,200

[1] Mineral Resources and Minerals Yearbooks, 1904 to 1935.

Geology[4]

The rough country along the west edge of the Mogollon Mountains is due to faulting along the west front of the range. Two distinct periods of faulting took place, both with relative downthrows to the west. The first faulting was along the east side of the San Francisco River valley and the second was two or three miles farther east. The steep cliffs along the west side of the range are the result of the second period of faulting, which took place along a single fault plane.

During the interval between faulting there was great volcanic activity. Great quantities of sandstone and other rocks of sedimentary origin probably represent periods of quiet between volcanic outbursts. The volcanic rocks were later cut by faults, which became filled with quartz and calcite and formed the principal ore deposits of the Mogollon area. The volcanic rocks were eroded and covered with a considerable thickness of gravel, after which the second period of faulting took place. Following this second period of faulting, the gravel was eroded from the higher eastern blocks exposing the volcanic rocks, and deep canyons were cut in the cliffs that form the fault escarpment. The high mesas, consisting of loosely consolidated gravel, between the San Francisco River and the Mogollon Mountains, represent the period of erosion that took place between volcanic activity and the second faulting.

The age of the volcanic eruptions is not known definitely, but some authorities consider that volcanic action took place in the early Tertiary. As there are considerable erosional unconformities, the action must have taken place over a considerable period of time.

The volcanic rocks of the district consist of andesites, latites, rhyolites, and rhyolite tuffs. The thickness of the series of Tertiary and Pleistocene rocks, as figured from the maximum observed thickness of each formation, is over 8,000 feet, over 80 percent being igneous rocks of volcanic origin. The mineral deposits are entirely in the volcanic rocks of the Tertiary period. The rocks of the Pleistocene are loosely consolidated gravels and sedimentary rocks.

The mineral-bearing veins of the district are fillings in fault fissures, the gangue mineral being mostly quartz and calcite. There are two systems of veins - the older system bearing approximately east and west and the more recent system bearing nearly north and south. The Queen vein, of the latter system, is the largest, most persistent, and most prominent vein in the district. It can be traced for several miles and traverses the entire district from north to south. It intersects many of the important veins of the east-west system, sometimes forming important ore shoots at the junctions. In general, the higher-grade ore has been found in the east west system of veins, but ore shoots of the Queen vein have, as a rule, proved to be wider, more regular, and more persistent.

---

[4] Ferguson, work cited.

The successive layers of igneous rocks, being cut by the two vein systems and subsequently eroded, have resulted in a seemingly impossible jumble of exposed formations. The veins, for the most part, are on the contacts between different rocks, but occasionally they are in one formation.

Water Supply

The lack of a dependable water supply for milling and domestic purposes has tended to impede the development of the district. Silver Creek is the principal source of supply for the Mogollon section and Mineral Creek for the Cooney section. During the dry season, these creeks furnish little or no water and the mills are operated on water from the mines and from wells. Curtailment of production and sometimes complete shutdowns are common during the summer months.

Shallow wells in the bed of the creek are the principal source of supply for Mogollon during the greater part of the year, and during the dry season they are the only source of supply.

The water supply for the limited population of Cooney is controlled by the only operating mine, which makes it possible for them to prevent pollution of the water obtained from wells during the dry season.

Whitewater Creek is about 2-1/2 miles south of Mogollon. Measurements taken over a period of years show that the flow has never been less than one cubic foot per second. It is from 800 to 1,000 feet below the town of Mogollon and, hence, its use as a source of domestic supply would involve the use of expensive pumping equipment. Its use for milling purposes would involve either pumping to the mills at Mogollon or transporting the ore to a millsite on the creek by aerial tram or truck or through a haulage tunnel.

Mogollon Consolidated Mines Co.

General

The Mogollon Consolidated Mining Co., A. P. Barrett, president and treasurer, Fort Worth, Tex., has lease and options on the Last Chance, Deadwood, and Eberle groups, about half a mile southwest of the town of Mogollon. The claims of the Last Chance group consist of the Frieda, Anna E., Last Chance, Top, Gold Dollar, Gold Dollar No. 2, Little Chance, Hub, and Boise City. The Deadwood group consists of the Deadwood and Simburst and the Eberle group of the Eberle and Braton.

The company began operations in July 1935. In July 1936, the production was from the Deadwood and Last Chance claims. The Eberle was temporarily shut down because of curtailed milling operations. The Deadwood and the Last Chance, on the Last Chance vein, adjoin each other where the vein bends to the south. The Eberle is on the Queen vein near its intersection with the Maud S. The Deadwood and the Last Chance mines are operated as a unit through the Deadwood shaft. The Eberle is operated from an adit tunnel, the portal of which is about a half mile north of the Deadwood shaft. The ore is hauled by truck from bins at the portal of the adit tunnel to the Deadwood mill.

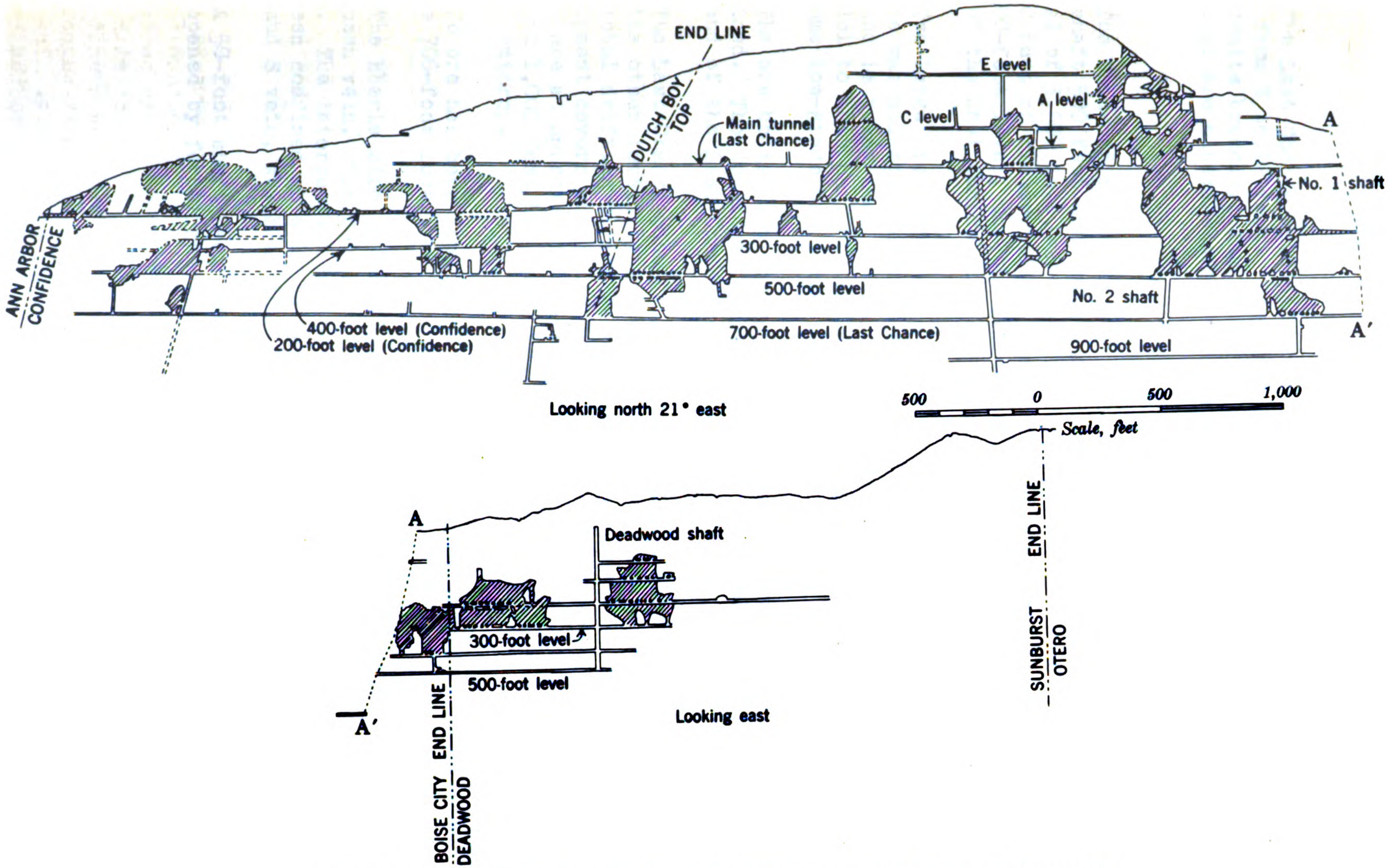


Figure 3.—Longitudinal projection of workings in Deadwood and Last Chance mines, Mogollon, N. Mex.

Geology

The Last Chance vein dips to the northeast at 65° to 75°; it ranges in width from 8 to 12 feet. The gangue minerals are quartz and calcite filling in andesite breccia. The better values are in the footwall quartz. The principal ore minerals are pyrite, argentite, sphalerite, and galena.

Development

The Deadwood mine (fig. 3) is developed through a vertical two-compartment shaft 500 feet deep with level intervals of 75 to 100 feet. There is a total of 3,500 to 4,000 feet of drifting on the Last Chance vein with 500 to 600 feet of crosscutting. The shaft was sunk from the 400-foot level to the 500-foot level, and the fourth and fifth levels connected with the workings of the Last Chance mine by the present operators.

Two large ore bodies were developed and mined above the third level. The ore was milled in a stamp mill which was recently converted to flotation and is being used by the present operators. The Queen vein, which is parallel to this part of the Last Chance vein, was crosscut in several places and some low-grade ore encountered.

The ore bodies did not reach the surface and very little oxidized ore was mined. The development work is on the Deadwood claim, which covers the west end of the Last Chance vein.

The Last Chance mine (fig. 3) is developed through an adit connected with the other levels by raises and winzes. There are eight levels in all, with total drifting on the Last Chance vein in excess of 20,000 feet. The development covers the entire length of the Last Chance and Top claims. The levels are at approximately 200-foot intervals, the lowest being at a depth of about 1,000 feet below the adit and 1,500 feet below the highest part of the outcrop.

No ore has been found on the 900-foot level and only a limited amount on the 700-foot level.

The Eberle mine is developed through an adit about 1,500 feet long on the Queen vein. The portal is near the intersection of the Queen and Maud S veins. The intersection has been exposed in the workings, but development has been confined chiefly to the Queen vein. A short crosscut intersects the Maud S vein, which at this location nearly parallels the Queen vein.

A 50-foot shaft near the adit portal is in ore and several stopes have been opened by former operators.

Mining Methods

Stoping. - When operations were first resumed in 1935, considerable ore was mined from pillars and from the sides of the old stopes where it had been left by former operators. This and the cleaning up and general rehabilitation work incident to starting up an old mine had kept mining costs relatively high. In June 1936, most of the production of 80 tons a day was from one stope on the fourth level on a vein that is parallel to and on the hanging-wall side of a worked portion of the main vein. This stope was from 8 to 12 feet wide, with a rib of waste from 5 to 15 feet thick between it and the old stope. Careful mining was required to keep from breaking through to the old stope in places where the two were close together.

Stoping is by the shrinkage method. The chutes are placed from 20 to 25 feet apart with pillars left in between. The thickness of the pillars, from the back of the drift to the sill of the stope, range from 8 to 10 feet. Raises or crib manways are carried up with the stopes at intervals of 75 to 100 feet, depending on local conditions.

The ore in the stopes is broken by breast rounds drilled with mounted drifting machines. By keeping the breast cuts down to 10 feet or less, most of the ore breaks small enough to be handled in chutes that are about 3 feet wide. Any large pieces that are exposed are blasted before they have a chance to get into the chutes.

The vein bulges and narrows in comparatively short distances along the strike, making it necessary occasionally to make extra set-ups for slabbing ore that was left in the walls unintentionally.

The number of holes required to break a round in the stopes ranges from 10 or 12 in ground that is mostly calcite to 18 or 20 in ground that is mostly quartz. In calcite one set of steel can be used to drill from two to four holes, but in the hardest quartz a set may be required for every hole.

Wet stoper machines are used in the raises and for cutting out chute pockets. Machine-sharpened steel is used in all machines. Detachable bits were tried when the mine was started up but were claimed to be not very satisfactory. One and one-fourth-inch hollow round steel is used in the drifting machines, and 1-inch quarter octagon in the stoper machines.

The machines in the stopes and drifts are operated by one man. The nippers deliver sharp steel to the machines, help set up, and collect the dull steel at the end of the shift.

Tramming and hoisting. - Ore and waste are trammed by hand and hoisted through the Deadwood shaft. A 2-ton skip is used in one compartment of the shaft for hoisting ore. The other compartment is provided with a cage and is used for men and material. A battery locomotive at the portal of the Last Chance adit will be used when operations are resumed in that part of the property.

Sampling. - All sampling is under the direct supervision of the mine engineer. The faces of the stopes and the development headings are carefully sampled each day by channel and grab samples. Enough car samples are taken from the chute and development headings to afford a close check on the mill heads.

Pumping. - Water from the Deadwood workings is pumped through the Deadwood shaft from the 500 or bottom level by a No. 5 Cameron pump. A boiler feed pump on the third level furnishes water for the rock drills. Some of the water from the Last Chance workings is pumped from the portal of the Last Chance adit to the mill and some sinks into the Last Chance shaft, which is in a porous part of the vein.

Ventilation. - Natural ventilation is provided by a large number of connections between levels and by openings left by old worked-out stopes. Forced ventilation is unnecessary.

Labor. - The mine is operated two shifts a day. Most of the common laborers are Mexicans. The foreman, shift bosses, and skilled laborers are Americans.

Classification of labor, number employed, and wage rates, Mogollon Consolidated Mines Co.

Class of Labor	No.	Rate per hour	Total amount for 8-hour day
Miners	13	$0.44	$45.76
Muckers	10	.33	26.40
Timbermen	4	.44	14.08
Pipemen	2	.44	7.04
Pipemen helpers	2	.33	5.28
Trammers	7	.33	18.48
Chuck tenders	6	.33	15.84
Shift bosses	2	5.00 (per day)	10.00
Hoistmen	2	.44	7.04
Cagers	2	.44	7.04
Timbermen helpers	4	.33	10.56
Nippers	3	.38-1/2	9.24
Powder men	1	.50	4.00
Sanitary man	1	.33	2.64
Crusher men	2	.33	5.28
Surface men	1	.38-1/2	3.08
Total per day	62		191.76

Besides the underground force, five men in the blacksmith shop are charged entirely to the mine. The blacksmith shop is run as a separate unit. The payroll is as follows:

2 blacksmiths at 44 cents per hour..........	$7.04
2 blacksmith helpers at 33 cents per hour...	5.28
1 drill doctor at 44 cents per hour.........	3.52
Total.......................................	15.84
Total, mine and blacksmith shop.............	207.60

Costs. - The following table shows ore breakage, development footage, drill shifts on stoping and development, and the amount of ore broken and milled for the first half of May 1936:

Ore broken in stopes, dry tons...............	3,713
Ore broken in development, dry tons.........	325
Ore milled...................................	2,070
Total number drill shifts, stoping..........	477
Total number drill shifts, development......	53
Ore broken in stoping per drill shift, tons.	7.78
Drifting, feet..............................	114
Crosscutting, feet..........................	16
Total development, feet.....................	130

Development and ore-breaking costs based upon a total breakage of 4,038 tons and a development footage of 130 feet are as follows:

	Labor	Supplies	Power	Total	Per ton	Per foot
Development:						
Drills and drilling.....	$356.60	$ 34.76	$42.33	$433.69	$0.11	$ 3.33
Tracks and pipe lines...	66.19	2.83	-	69.02	.02	.53
Explosives..............	-	262.80	-	262.80	.07	2.01
Timbering...............	144.04	30.00	1.20	175.24	.04	1.34
Tramming................	218.29	-	-	218.29	.06	1.67
Hoisting................	37.67	.96	5.21	43.84	.01	.33
Tools and sundry supplies	-	15.04	-	15.04	-	.12
Tool sharpening.........	30.02	8.72	3.78	42.52	.01	.33
Assaying, sampling, and surveying..............	22.58	12.66	1.15	36.39	.01	.28
Foreman and shift bosses	50.00	-	-	50.00	.01	.38
Total development....	925.39	367.77	53.67	1,346.83	.34	10.32
Ore breaking:						
Drills and drilling.....	2,455.89	306.53	254.00	3,016.42	.75	
Tracks and pipe lines...	258.25	9.00	-	267.25	.07	
Explosives..............	-	1,200.42	-	1,200.42	.30	
Timbering...............	484.02	101.06	5.03	590.11	.15	
Tramming................	1,199.86	52.59	15.28	1,267.73	.31	
Hoisting................	339.10	8.68	46.98	394.76	.10	
Tool sharpening.........	265.33	76.94	37.87	380.14	.09	
Tools and sundry supplies	2.60	138.17	-	140.77	.04	
Assaying, sampling, and surveying..............	145.89	38.00	3.54	187.43	.05	
Foremen and shift bosses	175.00	-	-	175.00	.04	
Surface tramming........	92.20	-	-	92.20	.02	
Total, ore breaking..	5,418.14	1,931.39	362.70	7,712.23	1.92	
Total, Last Chance...	6,343.53	2,299.16	416.37	9,059.06	2.26	

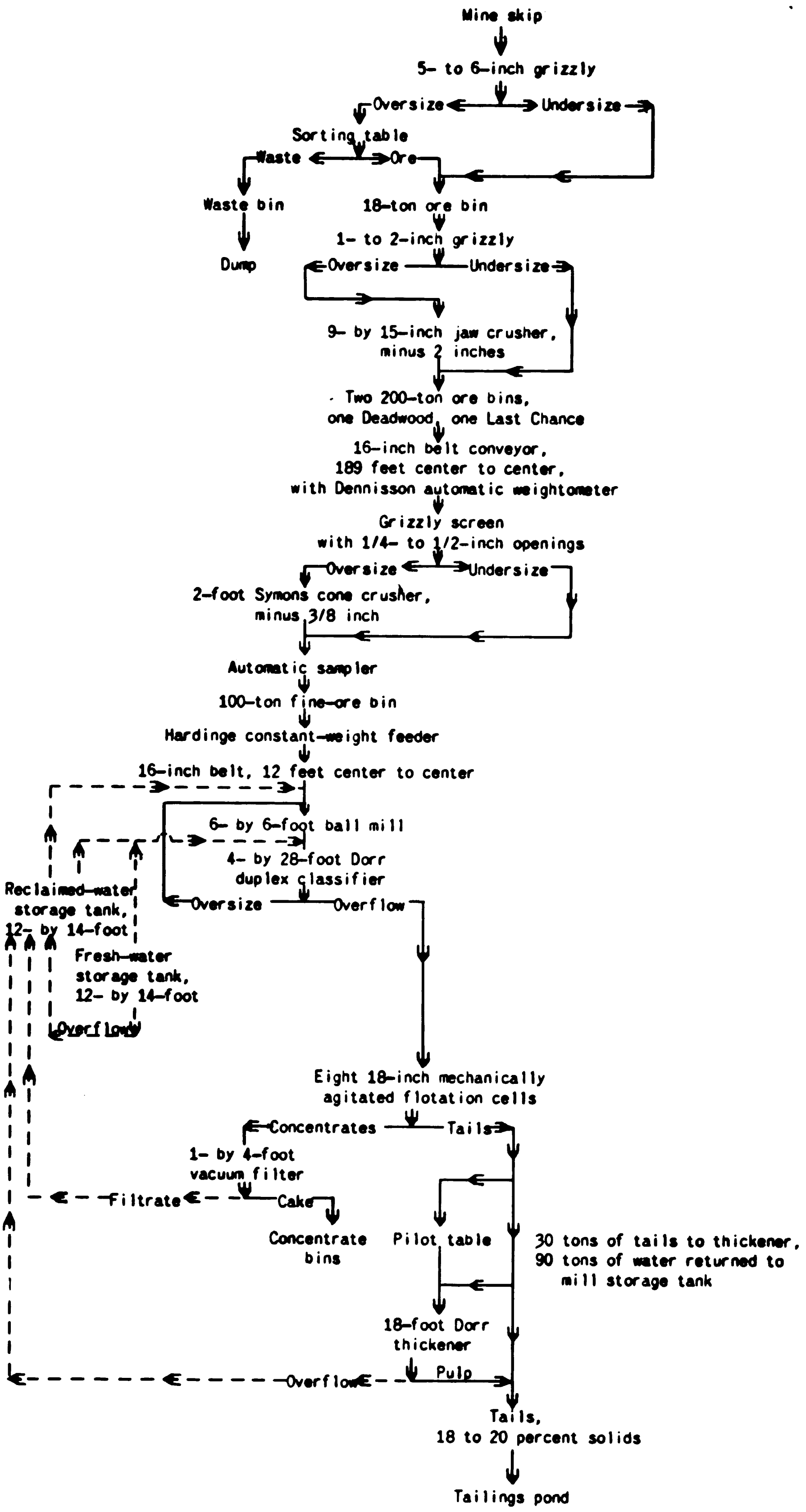

Mine skip
5- to 6-inch grizzly
Oversize
Undersize
Sorting table
Waste
Ore
Waste bin
18-ton ore bin
Dump
1- to 2-inch grizzly
Oversize
Undersize
9- by 15-inch jaw crusher, minus 2 inches
Two 200-ton ore bins, one Deadwood, one Last Chance
16-inch belt conveyor, 189 feet center to center, with Dennisson automatic weightometer
Grizzly screen with 1/4- to 1/2-inch openings
Oversize
Undersize
2-foot Symons cone crusher, minus 3/8 inch
Automatic sampler
100-ton fine-ore bin
Hardinge constant-weight feeder
16-inch belt, 12 feet center to center
6- by 6-foot ball mill
4- by 28-foot Dorr duplex classifier
Oversize
Overflow
Reclaimed-water storage tank, 12- by 14-foot
Fresh-water storage tank, 12- by 14-foot
Overflow
Eight 18-inch mechanically agitated flotation cells
Concentrates
Tails
1- by 4-foot vacuum filter
Filtrate
Cake
Concentrate bins
Pilot table
30 tons of tails to thickener, 90 tons of water returned to mill storage tank
18-foot Dorr thickener
Overflow
Pulp
Tails, 18 to 20 percent solids
Tailings pond

Figure 4.- Flow sheet of the Mogollon Consolidated mill.

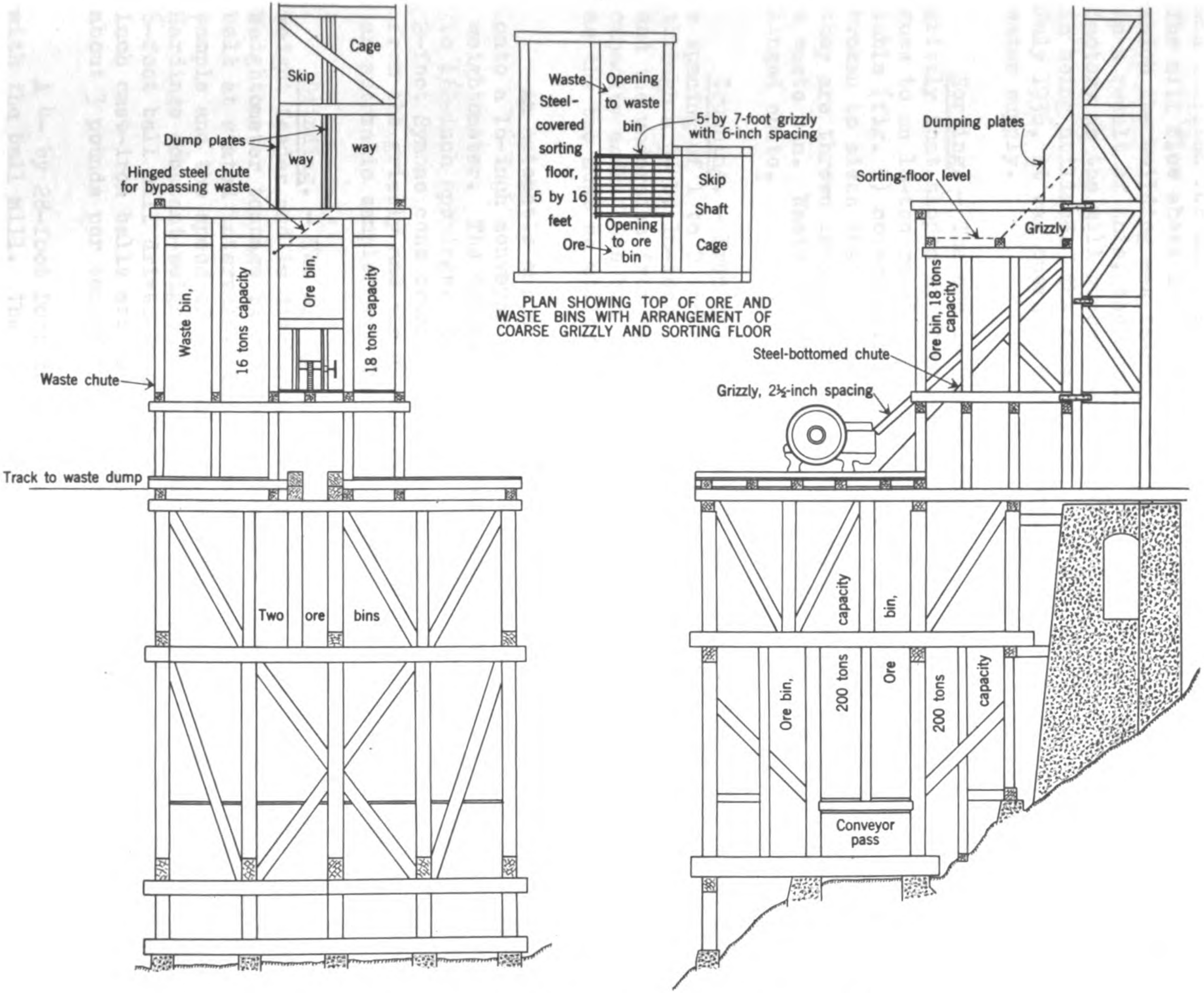

Cage
Skip
Dump plates
way
way
Hinged steel chute for bypassing waste
Waste bin,
16 tons capacity
Ore bin,
18 tons capacity
Waste chute
Track to waste dump
Two ore bins
Waste
Steel-covered sorting floor, 5 by 16 feet
Opening to waste bin
5- by 7-foot grizzly with 6-inch spacing
Skip
Shaft
Cage
Opening to ore bin
Ore
PLAN SHOWING TOP OF ORE AND WASTE BINS WITH ARRANGEMENT OF COARSE GRIZZLY AND SORTING FLOOR
Dumping plates
Sorting-floor level
Grizzly
Ore bin, 18 tons capacity
Steel-bottomed chute
Grizzly, 2½-inch spacing
Ore bin, 200 tons capacity
Ore bin, 200 tons capacity
Conveyor pass

Figure 5.—Ore bins and sorting floor of the Mogollon Consolidated Mines Co., Mogollon, N. Mex.

Milling Methods

General. - The old Deadwood stamp-mill building of timber construction was utilized for the present mill. The ore is concentrated by flotation. The mill flow sheet is shown in figure 4. According to the agreement under which the building was leased, none of the old equipment could be removed. As a result of this, the arrangement of the new equipment is not as satisfactory as the mill superintendent would like. None of the old equipment is being utilized. The capacity is about 160 tons daily. During June and July 1936, it was operated only three days a week owing to an inadequate water supply.

Sorting. - The ore is dumped from the mine skip on a 5- by 7-foot grizzly that slopes at about 45° and has 6-inch openings. The undersize goes to an 18-ton receiving bin and the oversize to a 5- by 16-foot sorting table (fig. 5) covered with sheet steel. The large pieces of ore are broken to sizes that can be handled by a 9- by 15-inch Blake crusher before they are thrown into the ore bin. The waste is sorted out and thrown into a waste bin. Waste from the mine is deflected into the waste bin by a hinged chute.

Crushing. - From the ore receiving bin the ore goes over a grizzly with a spacing of 1 to 2 inches and a slope of about 45°. The oversize goes through a 9- by 16-inch jaw crusher. The discharge from the jaw crusher and the undersize from the grizzly go into one of two bins of 200-ton capacity each. One bin is for the Deadwood ore and one for Last Chance ore, as the two must be milled separately.

An automatic apron feeder discharges the ore from the 200-ton ore bins onto a 16-inch conveyor belt 189 feet long and equipped with an automatic weightometer. The conveyor belt discharges onto a grizzly screen with 1/4 to 1/2-inch openings. The oversize from the grizzly screen goes through a 2-foot Symons cone crusher that crushes to minus 3/8 inch. The undersize from the grizzly and the discharge from the Symons cone crusher go through an automatic sampler and then to a fine-ore bin of 100-ton capacity.

Grinding. - The ore is taken from the fine-ore bin by a Hardinge constant-weight feeder and is discharged onto a 16-inch conveyor belt 12 feet long. Weightometer tonnage is checked by taking a 6-foot weighed sample from this belt at stated intervals. The tonnage is calculated from the weight of the sample and the speed of the belt as determined by a revolution counter on the Hardinge constant-weight feeder. The conveyor belt discharges into a 6- by 6-foot ball mill driven by a 125-horsepower motor. Cast-iron liners and 3-inch cast-iron balls are used in the ball mill. The ball consumption is about 3 pounds per ton of ore ground. The liners last from 9 to 10 months.

A 4- by 28-foot Dorr duplex classifier is operated in closed circuit with the ball mill. The classifier overflow runs from 60 to 75 percent minus 150 mesh, depending on the mill tonnage. The critical stage of grinding is about 80 percent minus 150 mesh but it has been found difficult to maintain grinding to this degree of fineness at the normal rate of 150 to 160 tons daily with the present grinding and classifying equipment. Reclaimed water is added at the ball-mill intake and reclaimed water and fresh water at the head of the classifier.

Flotation. - The classifier overflow goes to the first of eight 18-inch mechanically agitated flotation cells. Finished concentrates are taken from the first cell. The overflow from the second and third cells is returned to the first and the overflow from the last five is returned to the second. Pulp samples of flotation heads and tails are taken automatically.

Soda ash and coal-tar creosote are added at the feed end of the ball mill at the rate of 1 pound per ton of ore and 0.1 pound per ton of ore, respectively. Xanthate (Z-3) is added at the classifier overflow and at the head of the flotation circuit. Pine oil is added at the head of the flotation circuit.

The value of the mill heads ranges from $7 to $9 a ton, the average being around $8.25 a ton. About 60 percent of the values are in silver and 40 percent in gold. The ratio of concentration ranges from 70: 1 to 80: 1 and the value of the concentrates from $350 to $500 a ton. Tailings loss varies from $1.25 to $1.50 a ton. The following table shows the value of the heads, concentrates, and tails for the first half of May 1936. The values are based on smelter settlement prices of gold and silver, as follows:

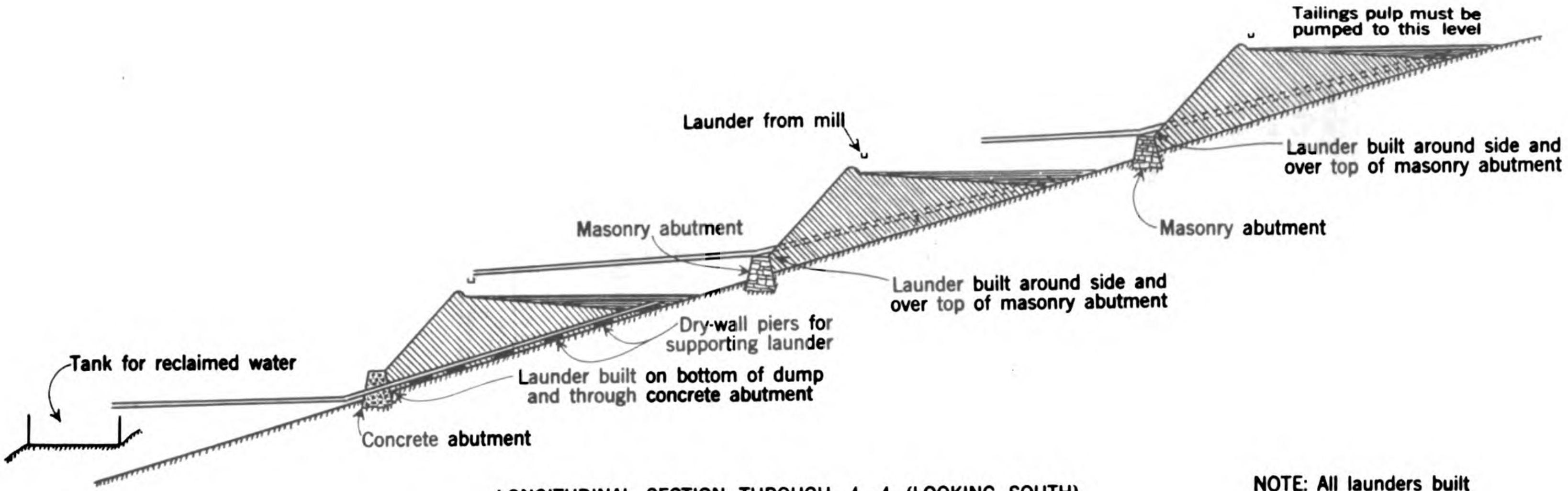
Gold, $33.00 per ounce.
Silver, 95 percent of 77 cents, or 73 cents per ounce.

	Tons	Gold, ounces	Silver, ounces	Gold, value	Silver, value	Total	Per ton
Heads........	1,913.65	196.05	12,933.48	$6,502.36	$94,441.44	$15,943.80	$8.33
Tails........	---	36.99	2,034.36	1,226.84	1,485.08	2,711.92	1.42
Heads (less tails)	---	159.06	10,899.12	5,275.52	7,956.35	13,231.87	6.91
Concentrates.	23.196	149.85	9,203.81	4,970.05	6,718.78	11,688.84	6.10

Ratio of concentration = 82.50 to 1 using $\frac{1,913.65}{23.196}$

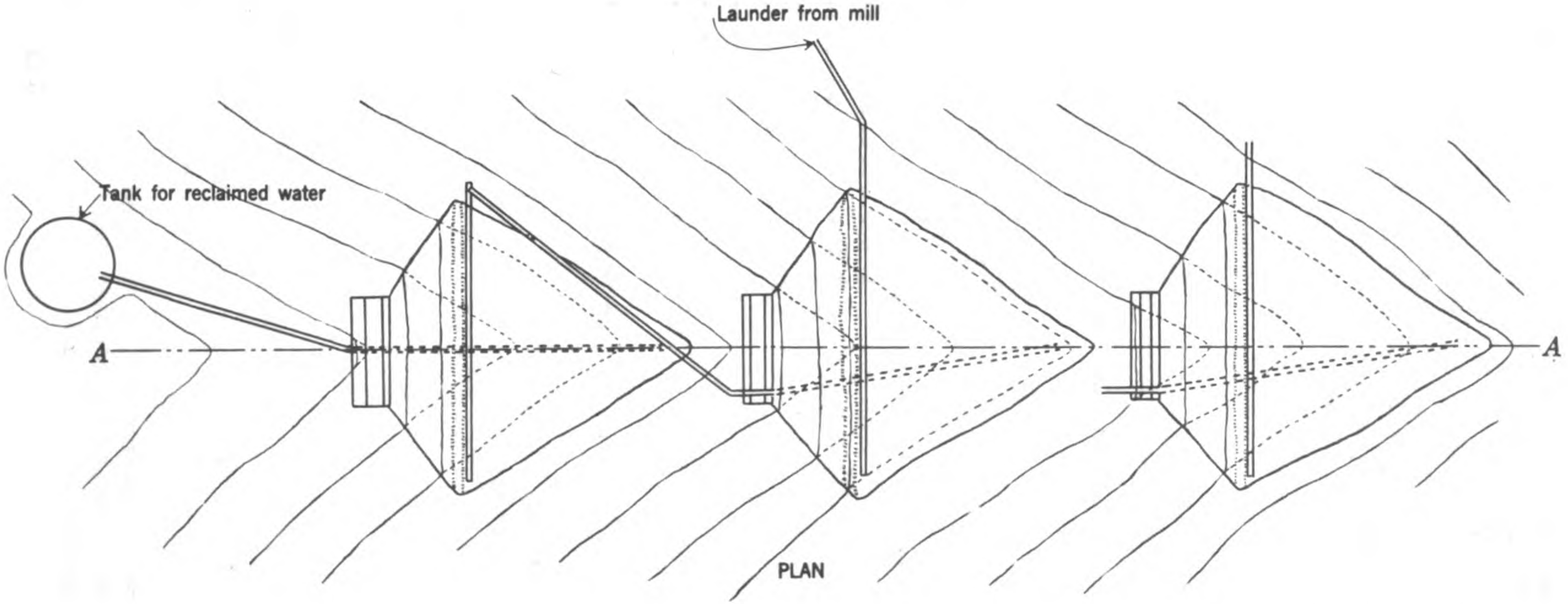
Mill recovery:

Gold.....81.13
Silver...84.27
Total....82.99


Tailings pulp must be pumped to this level
Launder from mill
Launder built around side and over top of masonry abutment
Masonry abutment
Masonry abutment
Launder built around side and over top of masonry abutment
Dry-wall piers for supporting launder
Tank for reclaimed water
Launder built on bottom of dump and through concrete abutment
Concrete abutment

LONGITUDINAL SECTION THROUGH $A-A$ (LOOKING SOUTH)

NOTE: All launders built of 2- by 12-inch plank



PLAN

Figure 6.– Sketch showing arrangement of dams, abutments, and launders of tailings pond of Mogollon Consolidated Mines Co., Mogollon, N. Mex. (Not to scale.)

Dewatering and filtering. - The concentrate goes through a 1- by 4-foot vacuum filter and then to the concentrate bins. The filtrate from the concentrate is pumped back to the mill storage by a vacuum-seal air lift. The tailing from the flotation cells is divided, one part going to an 18-foot Dorr thickener and the other direct to the tailing pond. A small cut of the tailing goes over an 18- by 48-inch pilot table and then to the Dorr thickener. The overflow from the thickener is pumped to the mill storage tank by a centrifugal pump operated by a 2-horsepower motor. The pulp from the thickener is raised by a diaphram pump and joined with the part of the tailing that goes direct to the tailing pond. The final tailing runs from 18 to 20 percent solids. About 90 tons of water are reclaimed daily from the thickener.

Power. - Current is generated and distributed at 2,400 volts and stepped down to 440 and 220 for power and lighting. Total connected horsepower in the mill is as follows:

Jaw crusher	15
Automatic apron feeder	1
189-foot belt conveyor	10
Symons cone crusher	25
Automatic ore sampler	1
Hardinge constant-weight feeder	0.25
12-foot belt conveyor	1
Ball mill	125
Dorr classifier	1
Flotation cells	20
Vacuum filter	.50
Vacuum pump	3
Pilot table	.25
Dorr thickener and diaphram pump	3
Centrifugal pump	2
Total	208.00

Tailing disposal. - The tailing, containing 18 to 20 percent solids is run to the tailing pond, a distance of 2,500 feet, in a wooden launder 8 inches wide and 8 inches deep with a grade of about 5 percent.

The dump is in a natural drainage channel on the side of a hill with a slope of 10° to 15°. Drainage from above is sufficiently controlled to prevent the impounded tailing from being washed away during cloudbursts.

The tailing is deposited on three tiers or benches. Figure 6 shows the arrangement of the launders with relation to the three benches. The upper bench was not in use in June because pumping is required to raise the pulp from the end of the launder to that level.

Past experience seems to have been that there is little danger of the deposits breaking away from the tops of the benches during cloudbursts, but that unless proper provisions are made, movement will start at the bottom, causing the whole mass to move downhill.

Such movements are prevented by concrete or masonry abutments built into the bedrock at the toe of each bench. The tailing is deposited by a launder built at the edge of each bench and sloped up from the top of the abutment at about the angle of repose for the material when dry.

The coarse material settles at the edge of the benches and is used for building up the dam to impound the water containing the slimes. The water, containing some slime, is run through a launder to the bench below and the operations are repeated. From the second bench the water comes off practically clear and is run to a storage tank, from which it is pumped back to the mill.

The launders from the two upper tiers are built around the sides and over the top of the abutment. The one from the bottom tier to the storage tank is on bedrock in the lowest part of the drainage channel, where it is covered by the tailing as it builds up, except at the intake. Additions are made at the intake of the launders as the necessity arises.

Four men are required at the tailing pond, building up the dams and building additions to the launders. The launders must be built on solid rock or on rock piers placed at intervals of 4 or 5 feet. If they are built on top of the tailing and then buried they will be broken and crushed as the material builds up and later settles. The cost of tailing disposal in May was 20 cents a ton.

Labor. - The mill is operated three shifts a day by 16 men, including the mill superintendent. The payroll is as follows:

1 mill superintendent	Salary.
3 operators	55 cents per hour.
3 helpers	38-1/2 cents per hour.
3 crushermen on Symons cone crusher	38-1/2 cents per hour.
2 laborers at drying and sacking concentrates	44 cents per hour.
4 laborers at the tailings pond	44 cents per hour.

The operation of the jaw crusher at the mine shaft is charged to mine-operating expenses.

Costs. - The following table shows the milling costs for May 1936 (total tons milled, 4,027):

	Labor	Supplies	Power	Total	Per ton
Coarse crushing....................	$ 731.01	$ 131.73	$ 66.29	$ 929.43	$0.23
Conveying and fine crushing........	339.81	138.29	102.81	580.91	.14
Fine grinding and classifying......	271.25	18.33	653.66	943.24	.23
Balls and liners...................	—	537.07	—	537.07	.13
Flotation..........................	264.13	18.35	110.10	374.58	.09
Reagents...........................	—	665.09	—	665.09	.17
Filtering and dewatering...........	255.11	44.50	47.12	346.73	.09
Concentrate drying.................	212.19	137.04	22.95	372.18	.09
Tailing disposal...................	607.01	168.97	15.28	791.86	.20
Concentrate freight................	—	247.88	—	247.88	.06
Water lines and pumping fresh water	151.95	23.46	35.47	210.88	.05
Assaying and sampling..............	114.55	53.43	4.61	172.57	.04
Supervision........................	250.00	—	—	250.00	.06
Lighting...........................	5.51	35.26	14.14	54.91	.02
Building...........................	27.61	—	—	27.61	.01
Totals........................	3,230.13	2,219.40	1,072.43	6,504.94	1.61

Freight and Smelter Costs

The concentrates are trucked 57 miles to Silver City by contract truckers. There is generally back freight, such as fuel oil and other supplies. The rate from Mogollon to Silver City is 20 cents per hundredweight. The rate on back freight is 30 cents per hundredweight.

The freight rate from Silver City to the El Paso smelter is $1.15 per ton, minimum car 25 tons, no sliding scale. The total freight from Mogollon to the El Paso smelter is $5.15 per ton.

The smelter pays for metals according to the following schedule:

Gold - $33.166 per ounce.
Silver - 77 cents per ounce for 95 percent if under 500 ounces per ton; 77 cents per ounce for 97-1/2 percent if over 500 ounces per ton.
Copper - Deduct 0.4 units and pay for 95 percent of the balance at market price less 2.525 cents per pound.

Charge and penalties:
Base - $4.20, no sliding scale.
Silica - No penalty.
Iron - No bonus.
Zinc - 5 percent free; charge $0.30 per unit excess.

Power House and Compressor Plant

The power house is about 1/2 mile south of the Deadwood mine. The building and some of the equipment are part of the old plant used by former operators. The main generating units used by the present operators were installed recently.

The generating equipment consists of two 6-cylinder, 300-r.p.m., 420-horsepower, full Diesel engines, each direct-connected to a 248-kilowatt, 3-phase, 60-cycle, 2,400-volt, 85.5 amperes per terminal generator, and one 2-cylinder, 180-horsepower, 200-r.p.m., semi-Diesel engine direct-connected to a 150-kv.-a., 250-volt, 360.8-ampere, 3-phase generator.

The semi-Diesel unit is used for emergency purposes only. It is connected with transformers at the power house so that the voltage can be stepped up for transmission. Power is transmitted at 2,300 to 2,400 volts.

The compressor plant is in the power house and is taken care of by the power-plant operators. The main unit consists of a 1,100-cubic-foot compressor belt-connected to a 150-horsepower, 2,200-volt, 39-ampere, 60-cycle, 3-phase induction motor. The emergency unit consists of a 300-cubic-foot compressor direct-connected to a 1-cylinder, 90-horsepower, semi-Diesel engine.

The plant is run three shifts a day by a chief engineer or operator and two assistant operators. The chief engineer received $5 a day and the two assistants 49-1/2 cents per hour.

Fuel oil cost 6.8 cents a gallon in Mogollon. The plant uses about 550 gallons a day, or 0.5 to 0.6 pound per horsepower-hour. The cost of generating current is about 1-1/2 cents per kw.-hr.

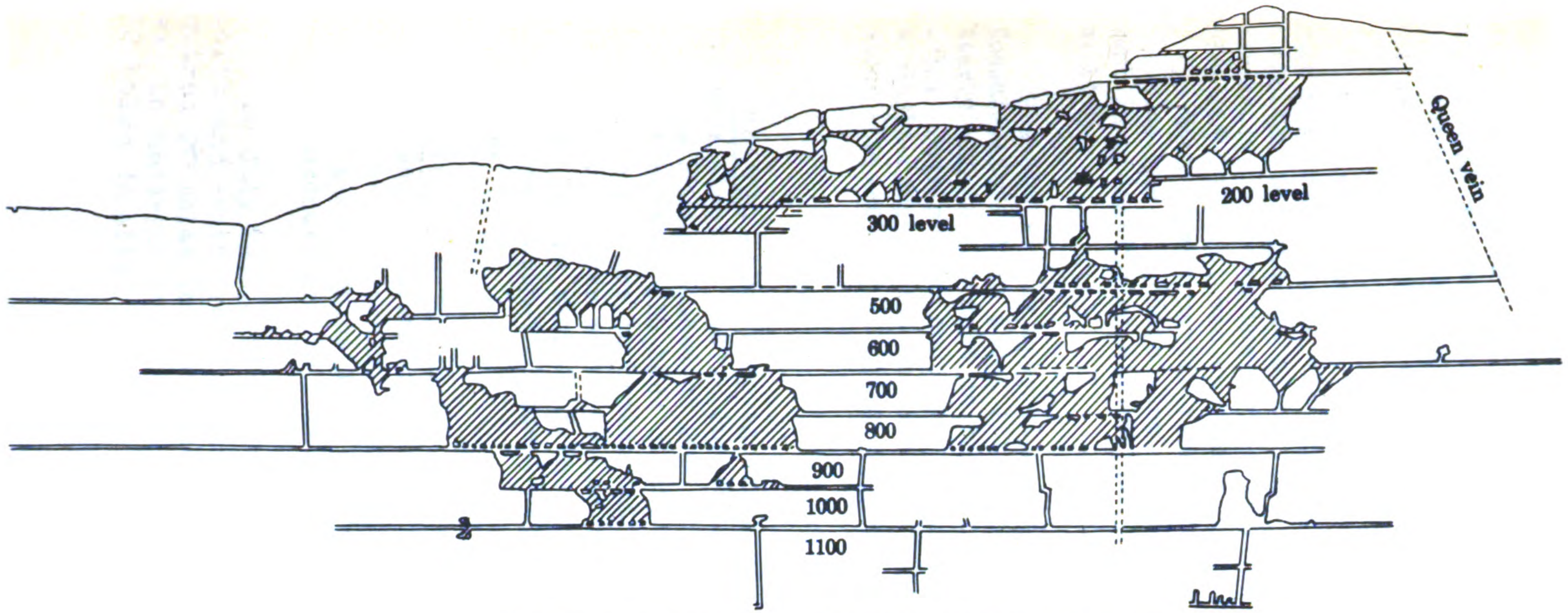
The power costs per ton of ore milled in May were as follows:

	Amount	Tons ore milled	Cost per ton
Mining	$362.70	4,027	$0.090
Development	53.67	4,027	.013
Milling	1,120.78	4,027	.278
Total	1,537.15		.381

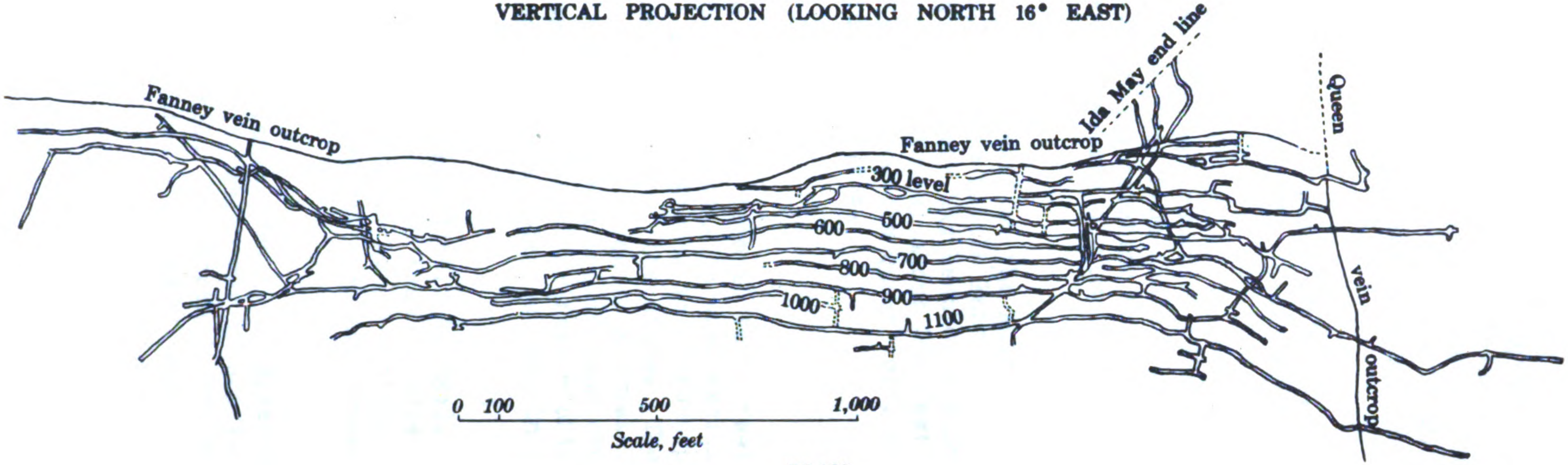
Black Hawk Consolidated Mining Co.

General

The Black Hawk Consolidated Mining Co., Theodore Trecker, Milwaukee, Wis., president, has a lease on 40 patented claims about 1/2 mile northwest of the town of Mogollon. The claims belong to the Lehigh Metals Co., Eugene Schimff, of Scranton, Pa., president. The property includes the Little Janney mine and 200-ton cyanidation mill and Diesel power plant, and a number of other groups of claims to the north of Silver Creek.



VERTICAL PROJECTION (LOOKING NORTH 16° EAST)



PLAN

Figure 7.—Plan and longitudinal projection of Little Fanney mine, Mogollon, N. Mex.

The Little Fanney mine (fig. 7) is one of the largest mines in the district. It is extensively developed through the Little Fanney shaft, which is 1,100 feet deep. The Little Fanney vein has been mined laterally for a distance of 2,000 to 2,500 feet, and down to the 1,100-foot level. There are several winzes below the 1,100-foot level but very little drifting and crosscutting. From some of the levels, the workings have been extended into the territory of adjacent properties.

The production of the Little Fanney up to 1919 was $4,869,000. The only production since then was in 1923, 1924, and 1925, during which time a limited tonnage was mined from the Little Fanney vein and from adjoining properties through the Little Fanney workings. The mill was operated in 1924 and 1925 but was shut down in January 1926 and remained idle until 1933, when it was partly remodeled for milling ore from another property. The mine has been idle since 1926. The shaft and hoisting equipment are kept in operating condition because of the necessity of pumping water for milling.

Present mining operations are on the Queen vein on the Andrew Jackson Consolidated claim about 1/4 mile northeast of the Little Fanney shaft. Nearly all development on this part of the property has been done since 1932. Development consists of an adit crosscut tunnel about 200 feet long, a single compartment incline shaft 300 feet deep on the Queen vein, and about 600 feet of drifting on each of the four levels.

Mining Methods

Stoping. - The stoping width of the ore ranges from 10 to 25 feet and averages about 15 feet. The shrinkage method of mining is used exclusively, with the chutes placed at 20- to 25-foot centers. Eight- to 10-foot pillars are left between the back of the drift and the sill of the stope. The ore from these pillars is broken and sent to the mill as soon as a level is mined out. Stoper machines are used in the raises and for cutting chute pockets. In the stopes, breast rounds are drilled with drifter machines. One and one-fourth-inch steel with machine-sharpened bits is used in the drifters.

Drifting. - The drifts are run 12 feet wide and double tracked. This is to speed the tramming enough for a production of 100 tons or more a day from one or two levels. Two machines are used in a 7- by 12-foot drift heading, each machine drilling from 16 to 20 holes for a round, depending on the hardness of the rock.

In July 1936, the drifts on the 300-foot level were being extended north and south from the shaft. The south drift, which was in quartz, required 20 holes on each side, or 40 holes in all. The north drift, which was in material containing more calcite, required 16 holes on each side, or 32 holes in all.

The machine men were given a clean set-up every morning. Drilling and blasting was done on the day shift and mucking on the graveyard shift. A helper in each heading brought the steel from the shaft to the machines, helped set up, and acted as chuck tender for the two machines after getting started.

Costs and other drifting data were not available.

Haulage and hoisting. - Tramming on the levels is by hand in ton cars. The ore is dumped into skip pockets, from which it is drawn into a 1-ton skip and hoisted to the main adit haulage level and dumped into an ore bin. Haulage from this bin to the mill bins is by a locomotive powered by a gasoline engine. The locomotive pulls a train of nine 1-ton cars. The airline distance to the mill is about 1/4 mile, but to keep on grade the car track is built around a ridge, making the distance between 1/2 and 3/4 mile.

Labor. - The company pays the prevailing wage scale of the camp. Muckers, nippers, and trammers get 33 cents per hour (1936). Timbermen, machinemen, hoistmen, and other skilled laborers get 38-1/2 to 40 cents an hour. The mine is normally operated on a 2-shift basis, but during June and July 1936, when development was being done on the third level, considerable mucking was done on graveyard shift.

From 65 to 70 men are employed underground to produce 100 tons a day. In July 1936 the number of machine shifts was as follows:

Place	No. machines	No. shifts	No. machine shifts
No. 3 level, south drift	2	1	2
No. 3 level, north drift	2	1	2
No. 3 level, stope preparation	2	2	4
No. 2 level, breaking pillars	1	2	2
Total			10

Costs. - From January 1 to May 1, 1936, 12,190 tons of ore were mined and milled. During the early winter, one of the generating units of the power house was shut down for nearly a month for repairs. During this time enough current was generated by the other units for the mill and the mine hoist only. Development and ore breaking were discontinued, but the mill was kept operating on the broken reserve, practically all of which was drawn by the time the necessary repairs were made, so that the compressor could be operated and ore-breaking and development work continued. The breakdown in the power house, together with difficulties that had to be overcome in catching up with the development work, is reflected in relatively high mining costs for the first four months of the year. Mining costs from January 1 to May 1, 1936 are as follows (tons mined and milled, 12,190):

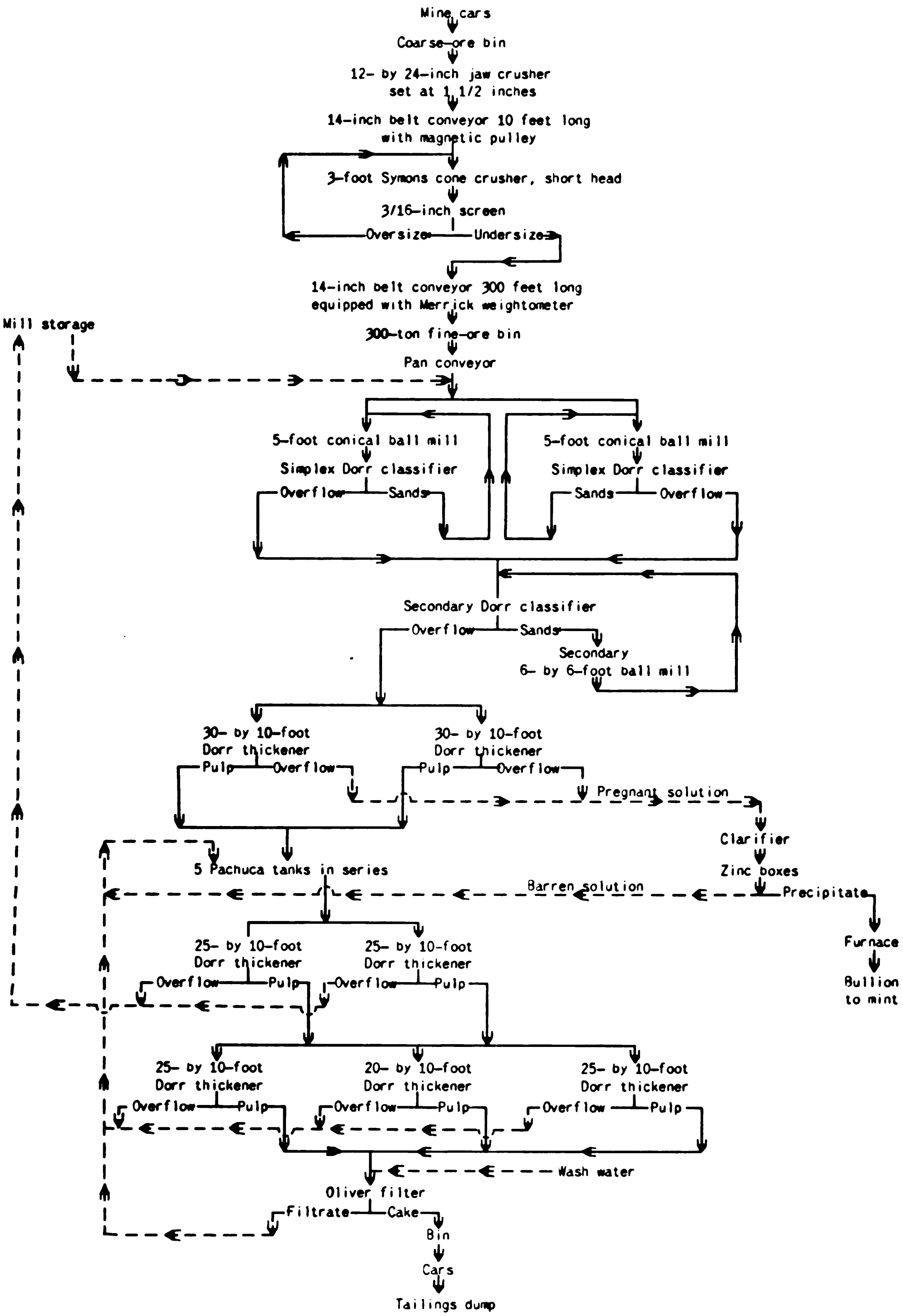

Mine cars
Coarse-ore bin
12- by 24-inch jaw crusher set at 1 1/2 inches
14-inch belt conveyor 10 feet long with magnetic pulley
3-foot Symons cone crusher, short head
3/16-inch screen
Oversize
Undersize
14-inch belt conveyor 300 feet long equipped with Merrick weightometer
Mill storage
300-ton fine-ore bin
Pan conveyor
5-foot conical ball mill
Simplex Dorr classifier
Overflow
Sands
5-foot conical ball mill
Simplex Dorr classifier
Sands
Overflow
Secondary Dorr classifier
Overflow
Sands
Secondary 6- by 6-foot ball mill
30- by 10-foot Dorr thickener
Pulp
Overflow
30- by 10-foot Dorr thickener
Pulp
Overflow
Pregnant solution
Clarifier
5 Pachuca tanks in series
Zinc boxes
Barren solution
Precipitate
Furnace
Bullion to mint
25- by 10-foot Dorr thickener
Overflow
Pulp
25- by 10-foot Dorr thickener
Overflow
Pulp
25- by 10-foot Dorr thickener
Overflow
Pulp
20- by 10-foot Dorr thickener
Overflow
Pulp
25- by 10-foot Dorr thickener
Overflow
Pulp
Wash water
Oliver filter
Filtrate
Cake
Bin
Cars
Tailings dump

Figure 8.- Flow sheet of Little Fanny mill of Black Hawk Consolidated Mining Co.

	Labor	Supplies	Explosives	Depreciation	Total
Supervision	0.166	—	—	—	0.166
Drill sharpening and steel	.099	0.100	—	—	.199
New rock drills	—	—	—	0.118	.118
Ore breaking	.660	.068	0.319	—	1.047
Drawing reserves	.152	.056	—	—	.208
Mucking and tramming	.442	.005	—	—	.447
Hoisting	.144	.004	—	—	.148
Motor haulage	.265	.023	—	.021	.309
Total	1.928	.256	.319	.139	2.642

Milling Methods

General. - The ore is treated by cyanidation in the Little Fanney mill, which was constructed by the original owners of the Little Fanney mine. A number of changes were made by the present operators. Flotation was tried, but the results were not very satisfactory and the equipment was changed back for cyanidation (fig. 8).

The mill capacity is 200 tons a day, but during the dry season there is not sufficient water for more than 100 to 125 tons a day. The water supply is from the Little Fanney mine shaft and from Silver Creek.

The mill heads run from $9.00 to $12.00 a ton. About 40 percent of the values are gold and 60 percent silver. Mill recovery ranges from about 88 to 93 percent. According to Ira Wright, manager of the company, recovery is better when the mill is not operated at full capacity, due, perhaps, to better agitation effected in the Pachuca tanks.

Crushing. - Ore from the mine cars is dumped, without being sorted, into a coarse-ore bin. From the coarse-ore bin it is fed by gravity through a chute gate to a 12- by 24-inch jaw crusher that crushes to minus 1-1/2 inch. The discharge from the jaw crusher is taken to a 3-foot, short-head, Symons cone crusher by a 14-inch belt conveyor about 10 feet long equipped with a magnetic pulley to remove tramp iron. The cone crusher is in closed circuit with a 3/16-inch screen. A 14-inch belt conveyor 300 feet long, equipped with a Merrick weightometer, carries the ore to an ore bin of 300-ton capacity in the main building.

Grinding. - The ore is conveyed from the fine-ore bin by a pan conveyor to two 5-foot conical mills, each operated in closed circuit with a Simplex Dorr classifier. The overflow from the Dorr classifiers goes to a secondary Dorr classifier, which is operated in closed circuit with the secondary 6- by 6-foot ball mill. The overflow from the secondary classifier is 50 percent minus 200 mesh.

Three-inch balls are used in the primary conical ball mills and 2-inch in the secondary mill. The ball consumption is 3.4 pounds per ton in the primary mills and 1.6 pounds per ton in the secondary mill.

The ends of the ball mills are lined with standard manganese steel end liners and the periferies with 4-inch steel rail sections. The sections are set on end in neat cement and wedged in with steel wedge bars. The cost of lining a conical mill with rail sections is about as follows:

Material, including end liners and labor of cutting rail section with an acetylene torch and making wedge bars	$455.00
Labor of installing rail sections and end liners	40.00
Total	495.00

The cost of lining entirely with standard manganese liners is $1,114. The rail lining lasts about 7 months and the standard manganese liners a little less. From 24 to 36 hours is required to line with rail sections. In order to permit the cement to set properly, the mill should not be used for 12 to 24 hours after it has been lined.

Cyanidation. - The overflow from the secondary classifier is divided into two equal parts. Each part goes to a 30- by 10-foot Dorr thickener. The overflow from these thickeners is the pregnant solution. The pulp goes through five Pachuca tanks in series and then through two secondary thickeners in parallel. The pulp from the secondary thickeners goes through three tertiary thickeners in parallel and the pulp from these goes through an Oliver filter. The overflow from the secondary thickeners is returned to the mill storage tank. The overflow from the tertiary thickeners and the filtrate from the Oliver filters are returned to the Pachuca tanks.

Litharge is added at the feed of the primary ball mills at the rate of 1/3 of a pound per ton of ore, and lime at the rate of 8 pounds per ton of ore. Cyanide is added at the first and third Pachuca tanks. The cyanide solution is kept at a strength of 4.2 pounds per ton at the first tank and 5 pounds per ton at the third tank. The cyanide gives better results if it is completely dissolved before it is added.

Precipitation and melting. - The pregnant solution from the primary thickeners goes through a clarifying tank and then to zinc boxes. The precipitate from the zinc boxes is melted down in a furnace and sent to the Mint. The barren solution from the zinc boxes is returned to the Pachuca tanks.

Tailings disposal. - After the tailings are filtered, they are run to a bin, from which they are drawn into a mine car and trammed to the tailings dump, which is on a steep hillside. The moisture content of the filtered tailings is from 7 to 9 percent. With this amount of moisture they lie at a greater angle of repose than would be the case for thoroughly wet or thoroughly dry tailings. This has resulted in the sides of the dump being steeper than desirable and has been the cause of some trouble in the past. During continued heavy rains the whole mass of material, upon becoming wet, slides down the hill.

Cost of tailing disposal is 23.9 cents per ton of ore milled. Of this, 19.6 cents is for labor and 4.3 cents for material.

Power. - Power is generated at the company's central Diesel plant. Current is generated and distributed at 440 volts. The motor hookup in the mill is as follows:

Jaw crusher	50
Symons cone crusher	25
Long conveyor	10
Pan conveyor	5
Hardinge mills	100
Marcy mill	50
Classifiers	15
Blower	25
Seven Dorr thickeners (estimated)	40
Oliver filter and vacuum pump (estimated)	5
	325

Costs. - Detailed milling costs, January 1 to May 1, 1936, are as follows (tons milled, 12,190):

	Labor	Supplies	Fuel	General	Total
Supervision	-	-	-	0.048	0.048
Crushing	0.216	0.141	-	-	.357
Grinding1/	.106	.219	-	-	.325
Cyaniding2/	.156	.666	-	-	.822
Tailings disposal	.196	.043	-	-	.239
Smelting	.034	.038	0.013	-	.085
Defrayed charges	-	-	-	.014	.014
Totals	.708	1.107	.013	.062	1.890

1/ Includes balls, $0.136 per ton.

2/ Includes cyanide, 0.352 per ton; lime, 0.062 per ton; and litharge, 0.020 per ton.

Power House and Compressor Plant

The power house was built in 1911; the original equipment, with a few minor changes, is still in use. Enough current is generated to supply the needs of the company and to furnish lighting for the town of Mogollon.

All current is generated at 440 volts. One line of 6,600 volts is used for transmitting power to the hoist at the mine. All other power is distributed direct from the generators.

The generating units consist of two 187-kilowatt, 3-phase generators, each direct-connected to a 260-horsepower De La Vergne semi-Diesel engine; one 100-kilowatt, 3-phase generator, belt-connected to a 180-horsepower De La Vergne semi-Diesel engine; and one 180-kilowatt, 3-phase generator belt-connected to a 260-horsepower De La Vergne semi-Diesel engine.

The plant requires from 0.52 to 0.54 pound of fuel per horsepower-hour. The cost of the fuel oil is 6-3/4 cents per gallon at the plant. The output is from 250,000 to 275,000 kw.-hr. per month at a direct cost of 1.545 cents per kw.-hr. Detailed power costs are as follows:

Supervision and labor..........	$0.00063	per kw.-hr.
Labor..........................	.00246	do.
Supplies.......................	.00008	do.
Fuel...........................	.00692	do.
Lubrication....................	.00231	do.
Total operation..........	.01240	do.
Depreciation...................	.00304	do.
Total....................	.01544	do.

The compressor is in the power plant and is taken care of by the plant operators. It has a capacity of 967 cubic feet per minute, altitude rating, and is run by a 125-horsepower electric motor.

Cooney Mining Co. Inc.

Situation and General

The property of the Cooney Mining Co., Inc., Robert W. Lyons, president, Shoreham Bldg., Washington, D. C., is in Cooney Canon about 1-1/2 miles north of the town of Mogollon and 1/2 mile east of the old town of Cooney, now practically deserted. Glenwood, about 10 miles distant, is the mailing address for the mine. There is an unimproved road from the mine to the main highway about 7 miles to the west.

The claims, twelve in all, are owned by John Hoover and Wm. J. Wetherby of Mogollon. The group is operated under bond and lease by the Cooney Mining Co., Inc. The claims include some of the first locations in the district. Patents were issued for some of them as early as 1880, but a number are still held by location. Five of the claims, the Copper Queen, Colonel, Apache, Victorio, and Geronimo, are on the Queen vein; they include the Queen mine, which is the present source of production. The Majestic, Majestic No. 2, Silver Lead, Silver Lead No. 2, Silver Twig, Silver Twig No. 2, and Sun are mostly on the Twig vein. They have been developed only to a limited extent.

The Queen mine was first opened up in 1895. It had been idle for a great many years when present operations began in 1934. Very little information is available with regard to output, but the limited extent of stoping would indicate a small production.

Geology

The vein dips from 65° to 75° to the east. It ranges in width from 3 to 10 feet and averages over 6 feet. The gangue mineral is principally calcite with inclusions of andesite fragments. Quartz occurs sparingly, but, as in the mines farther to the south, it is more abundant in the oreshoots than in other parts of the vein.

The ratio of gold to silver is higher than in most parts of the district, being about 1 to 25 by weight instead of the usual 1 to 50 or less. Copper minerals also occur in greater abundance than in other parts of the district, but not enough to interfere seriously with cyanidation.

The Queen mine was thoroughly sampled by cutting channel samples at 5-foot intervals, and assay plans were made of all workings. The values, as indicated by the samples from a typical block, are as follows:

Sample No.	Gold	Silver	Value
1	0.21	5.00	11.20
2	.32	8.00	17.36
3	.20	5.40	11.16
4	.21	5.00	11.20
5	.316	8.13	17.31
6	.200	6.20	11.77
Average	.243	6.29	13.33

In many places where the vein is narrower than the practical stoping width there is an overbreak and dilution of 20 to 25 percent. Taking this into consideration, the above samples will check closely with the mill heads that run about $10 a ton.

Development

The development work in the Queen mine is entirely on the Queen vein on the north side of Cooney Canon. An adit level, known as the Queen level, is 1,200 feet long and is connected by raises to two levels above, the first 700 feet long and the second 80 feet long. A winze from the Queen level, 120 feet deep, was not accessible. The level interval is 120 feet. The upper levels do not have direct connections to the surface. There are several worked-out stopes on the Queen level, but the amount of virgin ground is relatively large compared to most old mines in the district.

Development and prospecting at the Queen mine in June 1931 consisted of drifting north on the Queen level. The vein, being well defined, is easy to follow and very little crosscutting is done. In the spring of 1936 an adit drift was started on the Queen vein on the opposite side of the canyon from the Queen mine at an elevation of 75 to 100 feet above the Queen level. In July 1936 this drift was in 180 feet from the portal; the last 50 feet was in ore running from $6 to $8 a ton. This is the only development of importance on the Queen vein on the south side of Cooney Canon. One machine, working two shifts a day, was breaking from 20 to 30 tons. The ore was being dumped on a stock pile at the portal until a jigback tram could be built to transport it to the mill.

Mining Methods

Stoping. - During June and July 1936 the entire output of ore of about 50 tons a day was from development and stope-preparation work in the Queen mine. One machine was being operated two shifts a day on development work and another two shifts a day on stope-preparation work.

The shrinkage method of stoping is to be used. Some of the old worked-out stopes were started by leaving 5- to 8-foot pillars between the back of the drift and the sill of the stope. In other places stoping was started at the back of the drift with stulls and lagging used to form the sill of the stope. The chutes were at intervals of 15 to 20 feet.

Haulage. - The ore is trammed by hand through the Queen level to a bin just beyond the portal and at the top of the mill. Ore from the upper levels is transferred to the Queen level through raises used as ore passes.

Labor. - The mine payroll consists of 6 miners at $5 a day, 7 muckers at $4 a day, and 6 nippers and trammers at $4 a day, a total of $82 a day.

Compressor plant. - The compressor plant consists of two motor-driven compressors, each of 320-cubic-foot capacity and connected with multiple V-velt drives to 50-horsepower motors. A 670-cubic-foot compressor belt-connected to a 75-horsepower motor is used as a stand-by. The plant is in the same building as the power plant and is taken care of by the power-plant operators.

Milling Methods

General. - An old stamp mill, with alterations and improvements, is used as part of the plant and treats 50 to 60 tons of ore a day by cyanidation. A 4- by 8-foot rod mill and a Dorr duplex classifier were added to the grinding circuit and a Merril-Crowe precipitation plant was substituted for the zinc boxes that were used originally. The flow sheet is shown in figure 9.

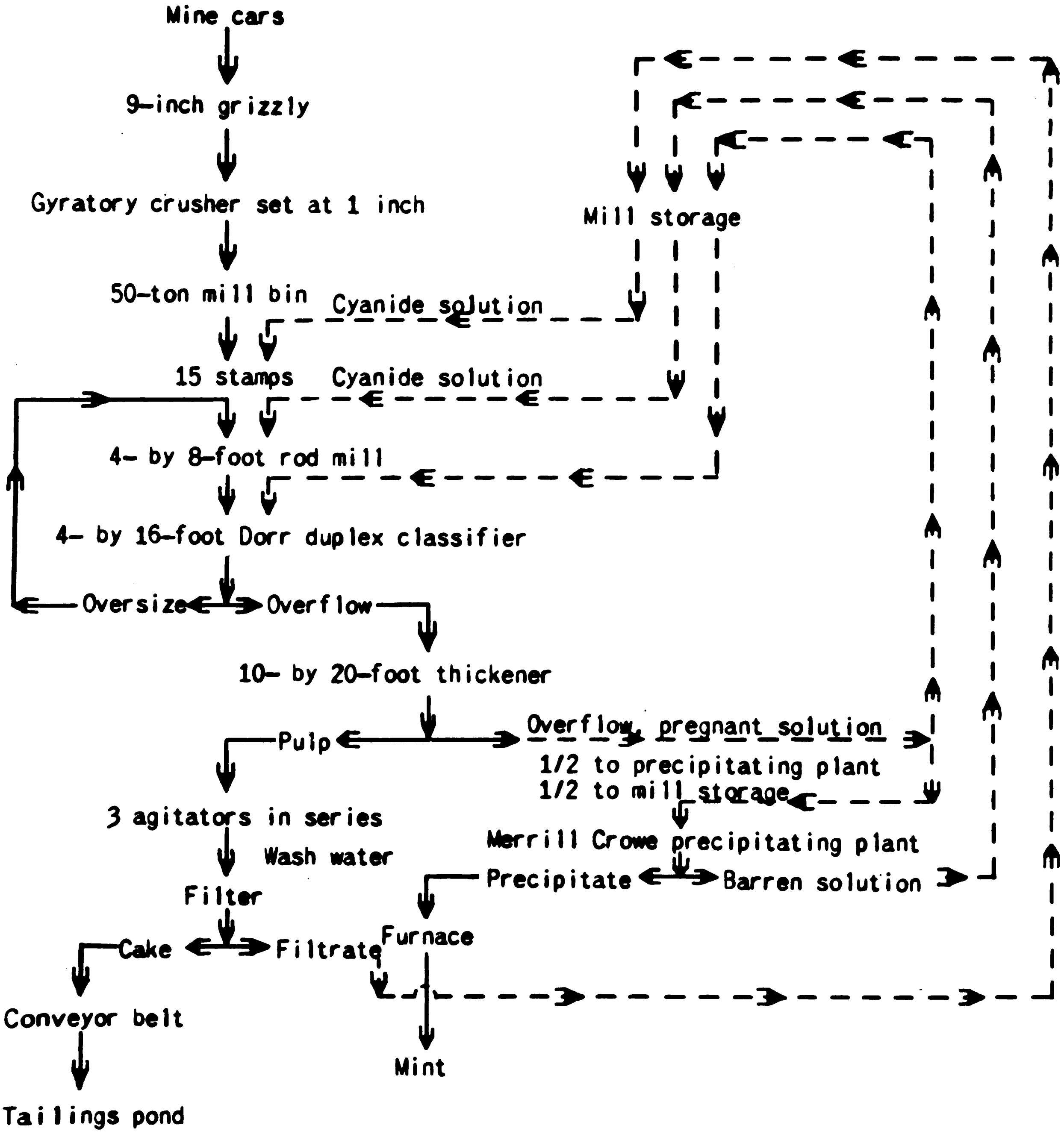


Figure 9.- Flow sheet, Cooney Mining Co. mill.

Crushing. - The ore is dumped from mine cars onto a grizzly with 9-inch spacing that discharges into a coarse-ore bin. The ore is drawn from the coarse-ore bin through a chute gate and into a gyratory crusher that crushes to minus 1 inch. The gyratory crusher discharges directly into a fine-ore bin of about 50 tons capacity.

Grinding. - From the fine-ore bin the ore goes through a battery of 15 stamps and then into the 4- by 8-foot rod mill in closed circuit with a Dorr duplex classifier. Lime is added at the stamp feed at the rate of about 4 pounds per ton of ore. Solution is added at the stamps, rod mill, and classifier.

Cyanidation. - The classifier overflow goes to a 10- by 20-foot thickener. The overflow from this thickener is the pregnant solution and is divided into two equal parts; one part goes to the mill storage tank and the other part to the Merril Crowe precipitation plant. Strong cyanide solution is added to the part that goes to the mill storage tank. The solution at the head of the circuit is kept at a strength of about 4 pounds of cyanide per ton of solution. The pulp from the primary thickener goes through three agitators and then to an Oliver filter. The filtrate from the filter is returned to the mill storage tank and the filter cake is taken by a conveyor belt to the tailings pond.

Precipitation. - The barren solution from the Merril Crowe precipitation plant is returned to the mill storage tank. The precipitate is melted in a furnace and sent to the mint.

The motor hook-up in the mill is as follows:

Crusher	15
Stamps	50
Rod mill	50
Classifier	3
Thickener	3
Agitators	12
Filter	5
Conveyor	10
Total	148

Costs and metallurgical data were not available. According to the assayer and the mill superintendent, the mill was making about a 90 percent recovery. The heads ran about $7 a ton in gold and $3 in silver.

Power Plant

The power plant, which is in a building adjoining the mill, consists of a 2,300-volt, 250-kilowatt, 3-phase generator direct-connected to a 325-horsepower De La Vergne semi-Diesel engine. A 30-kilowatt, 2,200-volt, 3-phase generator, belt-connected to a 40-horsepower Diesel engine, is used for emergency purposes. Current is generated at 2,300 volts and stepped down to 440 for use in the mill motors.

Four men per day operate the compressor plant and power house. The wages are $4 a day.

Idle Mines

Bearup

The Bearup mine is on the north bank of Silver Creek, 9 miles northeast of Glenwood and 3 miles west of Mogollon. The property, consisting of several unpatented claims, belongs to the Bearup estate, Wm. Bearup, of Mogollon, administrator.

The mine is just west of the range front fault scarp in country that has been very much broken up. The ore bodies consist of high-grade bunches of highly oxidized ore containing very few sulphides. There is very little silver and most of the gold is free. The mine has had a limited production but statistics thereon are not available.

There is a total of 3,000 to 4,000 feet of development work, consisting principally of a haulage level running east and west on the vein and another shorter level 41 feet above this.

The surface equipment consists of a flotation mill of 18 to 20 tons daily capacity, a blacksmith shop, a portable gasoline compressor, a boarding house, and it quarters 10 to 15 men.

The mill was run by a 75-horsepower gasoline engine connected to the mill machinery by belts and a line shaft. The crushing and grinding equipment consist of a jaw crusher and two 3-foot ball mills in closed circuit with a simplex classifier. The flotation circuit consists of three mechanically agitated cells and two pneumatic cells. The mechanically agitated cells are at the head of the circuit. The first made a finished concentrate. The overflow from the other four was returned to the head of the circuit.

The mill was built by a lessee, who operated it for only a short time. In July 1936 the mine and mill were idle.

Maud S.

The Maud S. mine is on the north bank of Silver Creek Canon, about 1/2 mile west of Mogollon. It was in this mine that the first silver-bearing sulphide ore in the district was discovered. The mine has been idle for a great many years and very little is known of the production. It is estimated that it has produced from $600,000 to $800,000 in gold and silver.

Development consists of an adit 1,100 feet long with an incline shaft near the portal and another at the end of the adit. The shaft on the west end reaches a depth of 700 feet on the incline and the one on the east end a depth of 250 feet on the incline. Besides the adit, there has been extensive development on the 500- and 700-foot levels from the west shaft.

The development is all on the Maud S. vein, which strikes roughly N 60° W and dips 60°N.

Deep Down

The Deep Down mine adjoins the Maud S. on the east. It is on the south bank of Silver Creek on a portion of the Maud S. vein that bears nearly north and south. The Maud S. forms a junction with one of the veins of the Queen group at the Eberle mine, where it has been exposed but not explored.

Stoping at the Deep Down mine was entirely from oxidized ores near the surface. The workings have been inaccessible for many years and not much is known about the extent of development or the extent of the production, which, however, is about $75,000. The workings are connected with those of the Maud S. through a shaft on the Maud S property.

Confidence

The Confidence property, owned by the Whitewater Mining and Power Co., consists of the Dutch Boy, Blackbird, and Confidence claims and adjoins the Last Chance property on the west (fig. 3).

The claims are on the Last Chance vein, which has been developed to a depth of about 1,000 feet. The underground workings are connected with the Last Chance workings on several levels. No ore has been mined below the 450-foot level and very little below the 250-foot level.

The mine was last operated in 1925. Production has been about $1,500,000. A mill on Whitewater Creek about 3 miles west of Glenwood was at one time operated in conjunction with the mine. This mill was later destroyed by fire.

Cooney

The Cooney mine is on the south bank of Cooney Canon on the Silver Bar vein at its intersection with the Twig vein. This was one of the first mines located in the district and was at one time the most productive. It was staked by Sergeant Cooney, who discovered the district. The Silver Bar vein strikes nearly north and south at its intersection with the Silver Twig vein, but north of the intersection it strikes northwesterly.

The ore contains chalcopyrite, bornite, chalcocite, and some galena. It runs higher in copper than any other ore in the district. It is stated that some of the ore contained 45 percent copper, but it was mined for the gold and silver. The copper mineralization decreased at depth and was replaced by iron.

The mine is extensively developed by an adit, a winze 760 feet deep, and six levels below the adit level. Most of the workings are caved, and no very definite information is available as to the extent of the ore bodies. According to old descriptions, some of the stopes are 30 feet wide and many are 12 to 15 feet wide.

Production up to 1905 was about $1,000,000, but the mine was operated since then. The total production has been estimated as high as $1,700,000.

Gold Dust

The Gold Dust mine, Theodore Carter, owner, El Paso, Tex., is about 1 mile south of Mogollon; the distance by road, however, is about 4 miles. It is about 1 mile north and 1,500 feet above Whitewater Creek. There are three claims on the Gold Dust vein, which bears approximately east and west, and two on the Queen vein, which bears north and south.

Development consists of two adits on the Gold Dust vein about 350 feet apart vertically. The lower tunnel is about 1,800 feet long and the upper about 500 feet long.

N. O. Bagge, of Glenwood, states that channel samples that he cut in the upper tunnel averaged around $16 a ton in gold and silver, but that the enriched portion of the vein is only 2 to 3 feet wide. The other part of the vein consists of clay on the walls which it would be difficult to keep out of the ore except by hand sorting, and which is very difficult to handle in a mill.

The lower tunnel is caved and inaccessible. Some small shipments of ore were made to the old Deadwood mill, but the production was small. The work was done by hand.

Ann Arbor

The Ann Arbor mine, Harry Herman estate, owner, is on the west extensio of the Last Chance-Confidence vein. It is about 1/2 mile from the Confidenc mine and 2 miles southwest of Mogollon.

Development consists of about 2,000 feet of adit on the Confidence vein.

Plant and equipment consist of a gasoline-driven compressor at the mine and a mill on Whitewater Creek about 3 miles east of Glenwood.

The mill was operated only for a few days intermittently on a very limited production. Production has been negligible.

Alberta

The Alberta mine, owned by the McKay estate of Pittsburgh, is about 1 mile north of Mogollon. There is one claim on the Queen vein adjoining the Little Fanney property and several on an east-west vein known as the Ida May. All claims are patented. It was operated by the owners from 1910 to 1915. It is developed by a shaft 200 feet deep and several hundred feet of drifting, a large part of which was done through the workings of the Little Fanney mine. No figures on production are available.

Golden Eagle

The Golden Eagle mine, owned by Sill Gamul of Mogollon, is about 1-1/4 miles northwest of Mogollon. It consists of two claims on the Golden Eagle vein, which bears N 30° W and dips 67° E.

There is a shaft from the surface about 70 feet deep and a tunnel 500 feet long on the vein. The shaft is not quite deep enough to connect with the tunnel.

Several small shipments of ore running about 1/2 ounce in gold have been made. The ratio of gold to silver is high - about 1 to 9 by weight. This is probably due to the oxidized condition of the ore near the surface and might point to the possibility of silver enrichment at depth.

Trilby

The Trilby mine, owned by ex-Senator Bursum, of Socorra, is about 1 mile northwest of Mogollon. It is developed by a shaft 200 feet deep and several hundred feet of drifting on the Trilby vein. It is connected with the Little Fanney workings and is accessible only through the Little Fanney mine. Most of the very limited production was shipped to the Little Fanney mill.

HILLSBORO DISTRICT

Situation

The Hillsboro district is in Sierra County, about 15 miles west of the Rio Grande River. The town of Hillsboro, with a population of 403 in 1930, is the county seat and is southwest of the district on the Percha River. It is the only settlement of importance in the immediate vicinity.

Facilities

The district is connected by good graveled highways to Lake Valley 18 miles south, Hot Springs 35 miles northeast, and Santa Rita 35 miles west. Rail shipments are handled through Lake Valley. El Paso, where the nearest smelter is located, is 120 miles from Lake Valley by rail and 126 miles from Hillsboro by highway. Trucking costs to El Paso are around $5 a ton.

The Percha River furnishes a supply of water that could be utilized for milling and domestic purposes, although it dwindles to a mere trickle during the dry season and sometimes dries completely. Most of the domestic needs of the town of Hillsboro are supplied by wells; some old mills in the district utilized water from the mines. A sufficient supply was developed recently by wells in the northeast part of the district to carry on extensive placer operations.

Climate and vegetation

Hillsboro, at an altitude of 5,236 feet, has a mean annual maximum temperature of 73.1°F. and a mean annual minimum temperature of 43.0°F., the annual average being 58.0°F. The annual precipitation averages 12.21 inches, most of which occurs in July and August. During these months cloudbursts are common and occasionally the highways are made impassable by washouts. Light snowfalls are common during the winter, but snow never covers the ground for more than a day or two, as the average annual fall is only about 10 inches.

The vegetation is sparse and consists mostly of greasewood and similar desert shrubs and bushes. In the valleys and low places, where the water table is near the surface, willows and cottonwood trees abound. Cedar and piñon trees are seen occasionally on the hillsides, and the alluvial planes to the east of the district have enough grass to support a few cattle for a few months during the year.

Topography

The Hillsboro district is in the foothills on the east slope of the Black Mountains. The elevation ranges from 5,000 feet at the placer deposits in the eastern part of the district to 6,100 feet on the highest peaks and the high slopes in the northwest part. The general nature of the topography is rough and hilly. The steepest slopes range from 15° to 20°, except on some of the highest peaks or in the deep ravines, where they may be as steep as 25° to 30°.

The alluvial deposits to the east of the foothills are comparatively level, except where they have been cut by gulches.

Geology[5]

The rocks of the Hillsboro district consist principally of andesite and latite flows and monzonite intrusions. Small patches of rhyolite and rhyolite tuff indicate that there was at one time a very extensive rhyolite flow probably covering the whole area to a depth of several hundred feet. This flow was removed subsequently by erosion. The fragments from this rhyolite form the principal part of the lower ends of the alluvial deposits to the east of the area. The main igneous area, which is of Tertiary age, is flanked on the northeast and the southwest by shales and limestone of the lower Paleozoic age. Faulting along the northeast and southwest indicate a relative downthrow of the igneous area. Limestone was encountered in a drill hole from the bottom level of the Rattlesnake mine at a depth of 1,100 feet below the collar of the Rattlesnake shaft. The relative downthrow is estimated to be about 1,400 feet owing to the position of similar limestone formations south of the fault.

---

[5] Harley, George Townsend, The Geology and Ore Deposits of Sierra County, N. Mex.: New Mexico Bureau of Mines Bull. 10.

The sequence of geological activity was briefly as follows: (1) Faulting first took place in the Paleozoic shales and limestones with a subsidence of the area now occupied by igneous rocks; (2) lavas consisting of latite, andesite and rhyolite were exuded and covered the whole depressed area between the faulting on the northeast and southwest. General subsidence may have occurred during or even after the time that the lavas were exuded; (3) intrusion of monzonite porphyry took place just north of the center of the depressed area and in the southwest along the fault plane; (4) latite dikes were formed in the andesite and latite flows. These dikes probably have their origin in the deep-seated source of the monzonite stocks, as they show a tendency to radiate from the larger of two. They later became the seat of the most productive veins of the district. Rich pay streaks that vary in width from 3 to 6 inches may be on either side or within a dike. There are other types of deposits, consisting of disseminated deposits in shear zones in the monzonite and replacement deposits in limestone, but these have been of little commercial importance.

The gold placer deposits of the district consist principally of alluvial fans formed from the erosion of the flows and intrusions of the igneous area. The lower parts of these fans consist mostly of rhyolite fragments and contain very little gold. This would indicate that the rhyolite flows that once capped the area to the west contained few mineral deposits. The upper part of the fans consists mostly of andesite, latite, and monozonite fragments and contain most of the gold. The valuable part of the deposit is roughly separated from the valueless part below by a false bedrock of caliche about 2 feet thick. After the fans were formed they were eroded by streams cutting through them and the caliche is exposed in many of the gulches. During this erosion, which is still going on, much of the higher-grade gravel was washed away and redeposited farther down the gulch, where it is found in irregular runs.

Deposits in Wicks gulch, Rattlesnake gulch, and Bonanzo gulch, although containing much less detrital material than the alluvial fans to north and east, have produced some rich placers, from which it is said several small fortunes were derived.

The principal fan in the district was formed from drainage to the east from the main monzonite stock through Grayback gulch and Dutch gulch.

History[6]

Detailed information on the discovery of ore in the Hillsboro district is not available. The first discoveries were probably made about 1875, as immediately after Sierra County became the principal producer of gold in New Mexico.

Production

The value of the metal production of the district from 1877 to 1931, inclusive, was as follows:

Placers:		
Rattle Snake placers	$40,000	
Wicks Gulch	100,000	
Luxemburg	2,000,000	
Miscellaneous	60,000	
Total placers		$2,200,000
Lode mines:		
Empire Bickford	1,000	
Garfield-Butler	40,000	
Bigelow	5,000	
Mary Richmond group	600,000	
Bonanza group	700,000	
Rattle Snake group	1,500,000	
Opportunity group	670,000	
McKinley-Sherman-Caballero	21,000	
Ready Pay mine	10,000	
Wicks group	150,000	
85 Mines	5,000	
Chance-Christmas-Feeder Extension	6,000	
Stemburg-Copper King group	8,000	
Happy Jack	6,000	
Tripp-Homestake	50,000	
El Oro-Andrews	200,000	
Miscellaneous	728,000	
Total lode mines		4,700,000
Total placers and lode mines		6,900,000

In July 1936, production from lode mines consisted of an occasional shipment of crude ore from old properties where rehabilitation and development work was being done and about 4 tons of high-grade sulphides were shipped from the Bonanza group.

---

[6] Harley, work cited.

Lode Mines[7]

General

The mine workings in the district are fairly extensive but none of them are deep enough to have encountered serious underground water difficulties. The deepest shafts are the Richmond, the Rattlesnake, the Opportunity, the Wicks and the El Oro, ranging in depth from 500 to 525 feet. The Bonanza mine, developed by tunnels, has attained a depth of 500 feet under the highest point of the hill.

Mining throughout the district was by a modified cut-and-fill method of stoping. The high-grade ore was sorted and run through ore passes to chutes in the drift below. The waste was used for filling in the stopes. Where the waste was not sufficient to fill the stopes, wall rock was broken or the stopes were left open.

Development work consisted of drifting along the veins on each level and following the high-grade streaks and drifting along the walls of the veins where the ore pinched out.

Wicks Mine

The Wicks mine is in Wicks Gulch, about 4 miles northeast of Hillsboro and about 3/4 mile west of the main highway from Hillsboro to Caballero. The property is held in trust by Walter K. Mallette, of Spokane, Wash., and is operated under lease by A. A. Luck, of Hillsboro.

Development consists of an adit 700 feet long, two incline shafts on the vein, one 525 feet deep and one 360 feet deep, and three levels from the shafts. No. 1 level is 800 feet long and is connected with the 520-foot shaft only. No. 2 level is 1,200 feet long and is connected with both shafts. No. 3 level is 700 feet long and is connected with both shafts.

The Wicks vein bears N. 15° E. at the Wicks mine, but farther to the south it bears due north and south. The dip is about 70° W. It is from 4 to 7 feet wide, with a pay streak ranging in width from 3 to 6 inches containing quartz, pyrite, bornite, chalcopyrite, and free gold. Hand-sorted ore is said to range in value from $50 to $200 a ton. Total production probably has been about $150,000.

Present operations consist of cleaning out and retimbering the shaft and preparing the levels for production. From 12 to 17 men are employed. Muckers are paid $2 a day and miners $3 a day.

Equipment consists of a gasoline hoist, gasoline compressor, jackhammer, stope, and blacksmith shop. Conventional bits are used. Water is supplied by bailing from the shaft.

---

[7] Harley, work cited.

Bonanza Mine

Situation. - The Bonanza mine is 3 miles north of Hillsboro and 2 miles north of the main highway from Hillsboro to Caballero.

The property consists of five patented claims owned by the Peterson Estate of Sweden and is held in trust by Miller Brothers of Kansas City and Edward D. Tilman of Hillsboro. It is operated under lease by the Las Animas Development Corporation, J. H. Brown, president, 29 South Street, Chicago.

History. - The history and early production statistics of the mine are incomplete and unreliable. A mill was constructed in 1904 and began operati in December of that year. From December 1904 until September 1905, the net returns of the mine were $7,099 from shipping ore, $4,321 from concentrates, and $23,801 from bullion, a total of $35,721. At first the mill had 10 stamps, but the number was soon increased to 20. The returns from three carloads of hand-sorted ore shipped in 1905 showed the following assays: Gold 8.65 ounces per ton, silver 32.3 ounces per ton, and copper 14 percent. It is estimated that the total production to date is about $700,000.

In 1931, development work was done by the Colorado-New Mexico Gold Mining and Milling Co., which opened the winze below the tunnel level and drifted north and south. Stoping was done for 200 feet along the drift to a height of about 30 feet. In 1932, the old mill was remodeled.

The mine was retimbered and dewatered recently and in July was reporte to be ready to go on a producing basis. Up to that time production had been limited to about 2 tons of high-grade sulphide a month. From 10 to 15 men were employed, but plans were being made to increase this to 25 or 3

Geology. - The vein strikes N. 37° E. and dips 80° to 90° northwest. It is from 2 to 8 feet wide and rather irregular. In some places it resembl a fracture zone and in others a shear zone with the ore streaks arranged in lenses that cut obliquely across the general strike of the vein.

The upper portion of the vein is oxidized and contains free milling gold, but the zone of oxidation and enrichment is very irregular. Considerable free gold was mined from the lower level, and sulphide ores were mined from the upper and intermediate levels. The minerals in the ore of the oxidized zone are chalcocite, argentite, limonite, calcite, and silica. In the shallow workings, free gold is found associated with limonite and in vuggy quartz, from which pyrite and chalcopyrite crystals were dissolved. The primary ore consists of pyrite, chalcopyrite, and small amounts of sphalerite and galena in a gangue of quartz and calcite.

Development. - The vein has been prospected by three adit levels. There is a total of 6,500 feet of tunnels and shafts. The intermediate tunnel is 3,500 feet long and extends completely through the mountain. The lower tunnel is about 2,000 feet long and reaches a depth of about 500 feet below the hilltop.

It is reported that stoping operations were very extensive and continuous, but it is very probable that many low-grade pillars were left. Much of the stope fill was carefully sampled and it is estimated that by screening, a milling product can be obtained averaging about $7 a ton.

Costs. - It is estimated that mining costs above the main tunnel, largely from old stope fills, would range from $1.50 to $2 a ton; milling costs would be from $0.50 to $1 a ton; and overhead expenses about 30 cents, making a total operating cost of $2.30 to $3.30.

Equipment. - The mine equipment consists of a 450-foot compressor direct-connected to 60-horsepower gasoline engine, an air hoist, one drifter, one stoper, and a jackhammer.

Placer Mines

General

Placer operations have been the principal source of gold production in the Hillsboro district for several years. Limited amounts have always been produced by sluicing and panning, but the increased production in the past two years has been due to a number of large-scale operations using portable washers with Ainlay bowls.

In 1934 and 1935, the John V. Hallett Construction Co. was the largest producer. In 1935, William Little completed installation of a washing plant at the Wakely Placer in Gold Run Gulch, 6 miles east of Hillsboro. The plant consists of a 3/4-yard dragline, a 1-1/4-yard shovel, and a portable washer with six Ainlay bowls. Seventy thousand yards of material was handled in 1935, but late in the year the plant was shut down and is still idle. The Hoot Owl placer was equipped with a dragline excavator having a daily capacity of 1,000 yards, a portable washer, and a 30-foot sluice box. The plant was operated only part of 1935.

John V. Hallett Construction Co.

The John V. Hallett Construction Co. of Kansas City is operating the property of the Animas Consolidated Mines Co. and the Glease lease. This is a consolidation of the Gold Dust and other placers consisting of about 1,200 acres in Dutch Gulch.

The plant consists of a portable Coulter Ainlay washing plant, two dragline excavators of 1- and 1-1/4-cubic-yard capacity, a caterpillar tractor, five storage tanks for water with a total capacity of 180,000 gallons, (reservoir capacity of 1,000,000 gallons), pumping equipment for six wells from 150 to 200 feet deep, and 4 miles of 3- and 6-inch pipe line. All machinery is powered by gasoline engines.

The Coulter-Ainlay washer consists of a hopper of about 2-yards capacity provided with a grizzly for rejecting boulders, a trommel washer that rejects all material larger than 1/4 inch, a stacker for disposing of the tailings, and four 36-inch Ainlay bowls. The washer, the stacker, and the four Ainlay bowls are all operated by a 65-horsepower Buda gasoline engine. All units are mounted on a heavy steel frame on wheels. Figure 10 is a flow sheet of the washer.

The plant is moved from one setting to another by means of a caterpillar tractor. It can be moved a distance of a mile or more and reset for operating in 2 hours.

One dragline excavator is used for stripping and one for supplying material to the washing plant. From 2 to 6 feet of material containing practically no values must be stripped from the surface. Roughly, 50 percent of the total excavating is stripping.

The normal capacity of the plant is about 300 cubic yards in 8 hours. In the event of water shortage, only three of the Ainlay bowls are operated, which reduces the capacity of the plant accordingly. Some water is reclaimed by collecting the run-off in pools and pumping it back to the washer after it becomes clear by settling. According to Mr. Hallett, the greatest operating difficulty is caused by a red sticky clay that is found in certain sections of the deposits. Such sections are unprofitable because of low recoveries and are avoided whenever possible.

The gravel is drawn from the hopper and run over a trommel screen, where water is added. Everything over 1/4 mesh is rejected, and the minus 1/4 mesh is run through the Ainlay bowls. The reject from the Ainlay bowls is pumped to the stacker with a Wilfley pump. The water trickles down from the stacker and is collected in a pool, where it clarifies and is pumped back and re-used.

According to Mr. Hallett, the recovered values amount to 50 to 75 cents a cubic yard for all material run through the washing plant. This checks roughly with the first runs that were made in 1933 by the Animas Consolidated Mines Co. in Dutch Gulch, where the average recovery from 70,000 yards was 39 cents per yard with gold at $20.67 per ounce. The tailing probably runs around 10 cents a cubic yard.

The cost of handling the gravel runs from 16 to 20 cents a cubic yard, including stripping. Pumping and other costs run from 4 to 5 cents a cubic yard, making a total of 20 to 25 cents a cubic yard. This does not include capital charges nor payment of royalties.

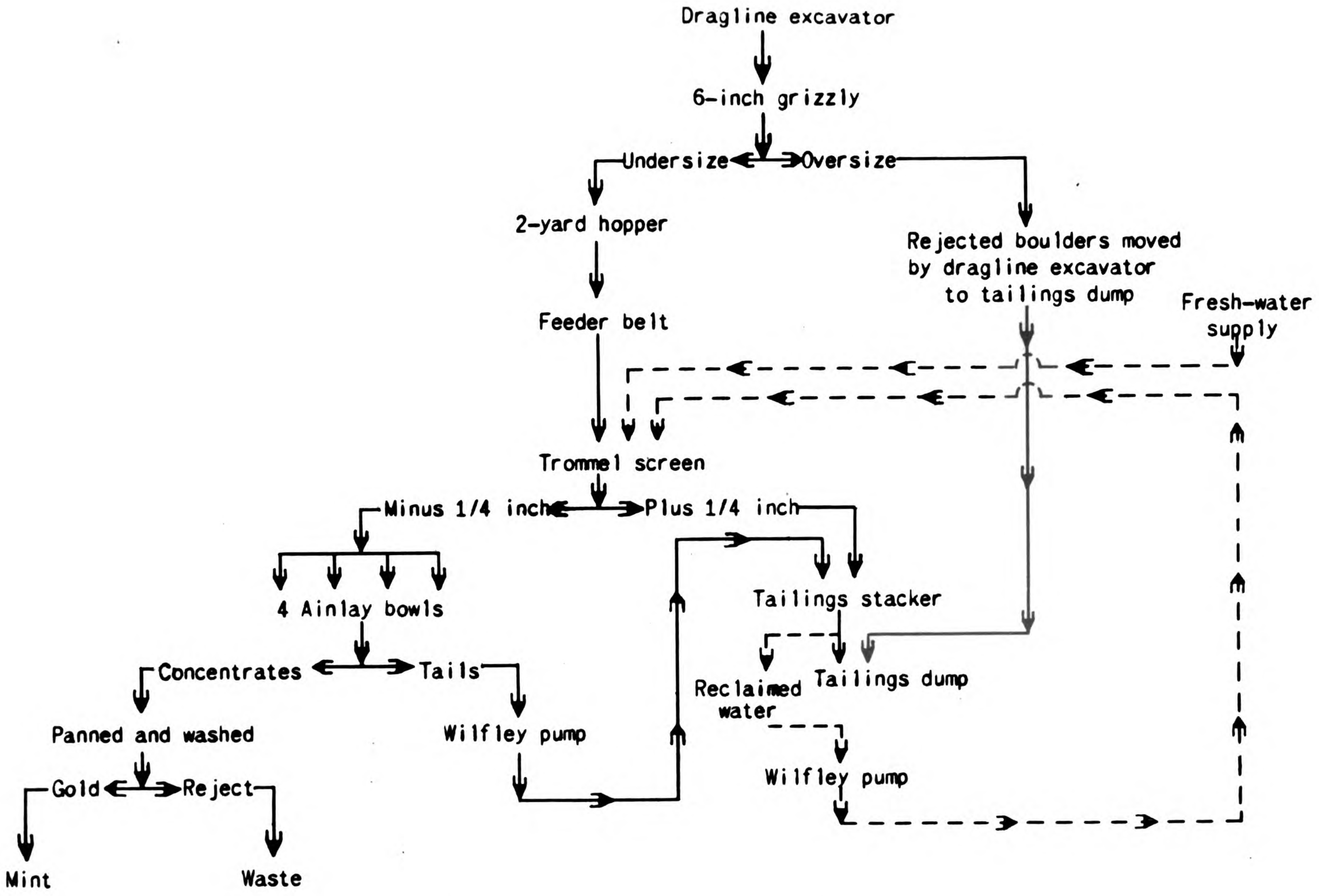


Figure 10.- Flow sheet of Coulter Ainlay washer used by John V. Hallett Construction Co.

The labor required to run the plant one shift a day was as follows:

1 foreman	$250	per month, or	$8.35	per day
3 dragline operators	75	cents per hour	18.00	do.
1 mechanic	60	do.	4.80	do.
1 operator and washer	75	do.	6.00	do.
1 oiler	40	do.	3.20	do.
2 laborers	40	do.	6.40	do.
1 pumpman	40	do.	3.20	do.
10			$49.95	

SHANDON OR PITTSBURG DISTRICT[8]

Situation

The Shandon or Pittsburg district is in Sierra County almost due east of Hillsboro and on the east side of the Rio Grande River. Pittsburg is a small settlement at the junction of the river and Apache Gulch, and Shandon is about 3/4 mile north at the junction of the river with Trujillo Gulch. The village of Caballo, with a population of 75, is on the west side of the river on the main highway from Albuquerque to El Paso. Hot Springs, with a population of 1,845, is 16 miles north. Hatch, with a population of 1,021, is the nearest railroad point 25 miles southeast. The main highway from Albuquerque to El Paso is on the west side of the Rio Grande River valley at Caballo and is paved north as far as Hot Springs and south to El Paso.

Topography

The elevation at the Rio Grande River is about 4,000 feet. The flood plain between the river and the foothills ranges in width from a few hundred feet to half a mile. The alluvial deposits between the flood plain and the Sierra Caballos are from 2 to 2-1/2 miles wide and consist of mesas sloping west toward the Rio Grande River and cut by gulches from the Caballos Mountains that lie just to the east. These mountains are from 5,500 to 6,000 feet high and very rugged.

Geology

The foothills consist of sand and gravel deposits ranging in thickness from 7 to 10 feet at the eastern border near the base of the Caballos Mountains to 60 or 70 feet near the river. Near the eastern border the gravel rests upon a bedrock of rhyolite and rhyolite tuff. In some places andesite is exposed. The gravel near the bedrock is cemented together by manganese oxides and caliche.

The Caballos Mountains consist of a base of pre-Cambrian granite capped by sediments that range in age from Cambrian to Pennsylvanian.

---

[8] Harley, work cited.

The gold-bearing gravels are chiefly in Trujillo Gulch and its tributaries. The gold probably had its origin in the gold-bearing quartz veins in the pre-Cambrian granite that forms the base of the Caballos Mountains. Near the river, where the gravel deposits are thickest, the gold values are said to be too low to work. Farther east, in the Trujillo Gulch, where they have an average depth of about 8 feet, the values are better and considerable mining has been done. In all, there are about 1,270 acres of placer gravels. About one-third of this area is in the gulches and their tributaries and the other two-thirds on the mesas between the gulches.

History

Gold was discovered at Shandon in 1901 and the deposits became known to the public in 1903. During 1904 and 1905 gold production from placers in Sierra County was 1,111 ounces and 2,316 ounces, respectively, most of which came from the placers in Trujillo Gulch. From 1905 until recently the production was unimportant due to lawsuits involving ownership rights. In 1931, legal controversies were settled and the property was taken under a 20-year lease by Caloway and Burke. Considerable sampling was done, and later equipment was installed and operations started.

Warnick Exploration, Ltd.

Situation and General

The original company that started operations in Trujillo Gulch in 1931 was refinanced and reorganized a number of times. At present, the property is being operated by the Warnick Exploration, Ltd., Benjamin C. Warnick, president, Dupont Bldg., Wilmington, Del. The company has title to 1,270 acres of placer ground with the water rights. Operations are about a mile east of the Rio Grande in Trujillo Gulch.

Mining Methods and Costs

Equipment consists of a grizzly for rejecting boulders, a bin or hopper of about 5 cubic yards capacity, steel-lined sluice box, a 1,000-gallon-per-minute, 4-stage centrifugal pump powered by a 200-horsepower Diesel engine, and a 1-3/8-cubic-yard dragline. Water is pumped from the Rio Grande River.

The material is loaded into trucks by the dragline excavator and delivered to the grizzly and sluice boxes. Trucking is done by contract truckers. Two or three trucks are used, depending on the length of haul. The sluice box is about 3-1/2 feet wide and 2 feet deep. Angle irons, steel rail-sections, and other similar material is used for riffles. The clean-up is made at the end of each shift and run through an Ainlay bowl.

A central sluicing plant was chosen in preference to a portable washer on account of the rough nature of the terrain where the operations are being conducted. When moving the excavator to a new location, it is sometimes necessary to stop operations from 1/2 to 2 days for building roads for the trucks. Up to the present time it has been necessary to haul the material from 1/4 to 3/4 miles. In the event of greater distance, it would not be a very great task to move the whole sluicing plant to a more favorable location.

The total operating costs of delivering the material to the sluice box, pumping water for sluicing, and cleaning up are from 20 to 25 cents a cubic yard. The lowest recovered values were 40 cents per cubic yard and the highest $1.02 per cubic yard. The bullion is sent to the United States Mint in Denver.

The plant is operated two shifts a day, the average daily capacity being about 600 cubic yards.

Labor

The labor required to operate the plant on a 2-shift basis, exclusive of trucking, which is done by contractors, is as follows:

Dragline operators	2
Oilers	2
Laborers	6
Pumpmen	2
Total	12

The company furnishes quarters, but the men pay for their board at the company boarding house. The wage scale is relatively low.

PINOS ALTOS DISTRICT

Situation

The Pinos Altos district is in Grant County, about 7 miles north of Silver City.

The town of Pinos Altos, with a population of about 250, is the only settlement in the immediate vicinity. The district is served by a graveled highway and a branch of the Santa Fe Railroad from Silver City. The highway is maintained in good condition, but the railroad has not been in operation for a number of years.

There are a number of old mills and one of more recent construction in the district, but none of them have been in operation in recent years. What little ore is mined is shipped in the crude form to the El Paso smelter. Transportation to Silver City is by truck, and from Silver City to El Paso either by truck or rail but mostly by rail.

Geology[9]

The rocks of the district comprise an intrusion of granodiorite porphyry in a complex of diorite porphyry and associated dykes. Veins were formed in both masses and cut across the contacts without interruption. The diorite porphyry forms the crest of the Pinos Altos Mountains, while the granodiorite is found along the lower eastern slopes.

The important fissure of the district trends from N. 18° E. to N. 30° E. and dips steeply either to the east or west. The outcrops are prominent and in some cases can be traced on the surface for a mile or more. The widths of the veins range from a few inches to 6 feet, generally between firm walls. The vein minerals consist of quartz, pyrite, chalcopyrite, sphalerite, galena, gold, and silver. Barite and rhodochrosite are rarely present.

General Mining Practice

Mining practice throughout the district consists mostly of horizontal cut-and-fill stoping; in a few places veins were encountered of sufficient width and regularity to permit shrinkage stoping. Conditions in most mines favor the horizontal cut-and-fill method of stoping as it provides a means of disposing of waste that must be broken with the ore in narrow veins.

In 1935, shipments were made from six mines and dumps - the Golden Rule, Golden Giant, Hazard, Kept Woman, Langston, and Savannah Copper Co. The New Mexico Mining Corporation, a subsidiary of the International Mining Corporation of New York City, did extensive development work on about 50 mining claims, including the property of the Savannah Copper Co., but before the end of the year operations ceased and the options were relinquished. Placer gold was produced by individuals engaged in panning and rocking operations. Present activities are limited to two properties.

Hazard Mine

The Hazard mine is about 2-1/2 miles northeast of the village of Pinos Altos. In July 1936 the mine was operated two shifts a day and employed from 12 to 15 men. Two jackhammers were in use, one at development and one at ore breaking. Monthly production consisted of 20 to 25 tons of oxidized gold, silver, copper, and lead-bearing ore, which was shipped to the El Paso smelter.

Equipment consists of a gasoline hoist and a gasoline 2-drill portable compressor.

---

[9] Paige, Sidney, The Ore Deposits Near Pinos Altos, N. Mex.: Geol. Survey Bull. 470, 1910, pp. 109-125.

Golden Rule Mine

The Golden Rule mine is about 1/2 mile north of Pinos Altos and just east of the Pinos Altos Redstone highway. It is being operated under lease by Ed Symons of Silver City. During the summer of 1931 a carload shipment of about 25 tons was made each month. The mine was operated one shift a day and employed four men - one to run the hoist and three underground. One jackhammer was in use breaking ore.

Equipment consists of a gasoline hoist and a gasoline protable compressor.

STEEPLE ROCK DISTRICT[10]

Situation and Facilities

The Steeple Rock district is in the western part of Grant County near the Arizona-New Mexico line. It is served by a branch road in fair condition from Duncan, Ariz., 22 miles southwest.

East Camp Group of Claims

Surface buildings and mine equipment were installed on the East Camp group of claims in 1934. Development on this group consists of a 330-foot shaft and drifts on the Davenport claim and a 380-foot adit drift and raises on the McDonald claim. Additional development was done on both of these claims in 1934, and production was started about March 1 and continued throughout the year. The ore was shipped crude to the El Paso smelter.

Production

Available production figures for 1934 and 1935 are as follows:

Year	Tons	Gold, ounces	Silver, ounces	Copper, pounds
1934	1,534	413	20,630	1,700
1935	903	269	14,801	1,285
Total	2,442	682	35,431	2,985

This indicates that the average grade of the ore is as follows: Gold, 0.279 ounce per ton; silver, 14.5 ounces per ton; copper, 0.61 percent.

---

[10] Henderson, Chas. W., Gold, Silver, Copper, Lead, and Zinc in New Mexico: Minerals Yearbook, 1935, p. 284, and 1936, p. 317.

BURRO MOUNTAIN DISTRICT

Situation

The Burro Mountain district is near Tyrone, 11 miles southwest of Silver City and about a mile west of the Silver City-Lordsburg highway.

Production

In 1934 and 1935 small amounts of oxidized gold-silver ore were shipped to the El Paso smelter from the Contact group of claims of the Phelps Dodge Corporation. The Shamrock group of claims produced a small tonnage that was treated in a plant equipped with a small ball mill, amalgamation plates, and concentrating tables. The concentrates were shipped to the El Paso smelter and the bullion to the Denver Mint.

The entire production of the two groups for 1934 and 1935 was probably from 300 to 350 ounces of gold. Production continued intermittently during most of 1936.

MT. BALDY DISTRICT

Situation and Facilities

The Mt. Baldy district in the Sangre de Cristo Mountains is in the western part of Colfax County, about 30 miles south of the Colorado State line. Elizabethtown, the largest settlement, has a population of about 150.

The district is served by the main highway from Colfax to Taos and by a branch highway from Therma on the main highway, through Elizabethtown to Red River and Questa. A branch line of the Santa Fe railroad runs from Dillon to Ute Park. The nearest railroad point is about 11 miles east of Therma.

Water Supply

The district is over 10,000 feet above sea level; owing to this high altitude, there is considerable precipitation. There is no water shortage, except at some of the placer operations high up on the slopes of Mt. Baldy, where the streams are small. Ute Creek and other streams furnish an adequate supply for milling.

Geology[11]

Mt. Baldy, the highest peak in the district, with an altitude of 12,400 feet, is made up of faulted sedimentaries intruded by quartz monzonite porphyry. The igneous rocks occur as numerous dikes and sills intruded into the Pierre shale. On the lower slopes of Mt. Baldy, at an altitude of about 10,500 feet, a basal conglomerate rests unconformably upon the Pierre shale. The gold deposits of the district appear to be very definitely related to the igneous intrusives, but the commercial deposits are mostly on the contact of the conglomerate and the shale. In some cases they are in the conglomerate, but for the most part they are in the shale for a distance of a few inches up to 5 feet from the contact. They are roughly lenticular in shape and comparatively flat, having little more slope than the general contact of the shale and conglomerate. They appear mostly on the down-hill side of anticlinal folds.

---

[11] Lee, Willis T., The Aztec Gold Mine, Baldy, N. Mex.: Geol. Survey Bull. 620, p. 327.

History[12]

Copper ore was first discovered in the district between 1860 and 1865. In 1866 placer gold was discovered by a party sent out to do development work on a copper prospect on Mt. Baldy. In the summer of 1867 placer mining began in the region that later became known as the Elizabethtown district. It has been estimated that $2,250,000 was produced by placering, but after a few years it was discontinued as most of the deposits were in gulches high up on the steep slopes of Mt. Baldy, where water was scarce.

Placer gold was found in the draws that came from Mt. Baldy; this led to the search for and discovery of the gold lode that later became the site of the Aztec mine. The discovery was made in June 1868, and by November of the same year development had progressed sufficiently to start production, and a 15-stamp mill had been built and put into operation.

For the first two years the mine produced as much as $21,000 a week, and over a million dollars was taken out by the end of the fourth year. Production previous to 1909 has been estimated to be from $1,250,000 to $1,500,000.

Soon after the discovery of the Aztec mine, the district became prominent, and an English syndicate purchased the Maxwell land grant of 1,700,000 acres, of which the district is a part. The grant was first made by Mexico in 1843, and in 1861 it was confirmed by the United States Congress. By 1872 the ore body of the Aztec mine, which produced such rich returns, was worked out and the mine became involved in litigation. During the 40 years that followed, only spasmodic attempts were made to open new ore bodies, and production in the district was unimportant except for placers. In 1908 and 1909 exploration and development work was started on the Aztec and other mines in the district. The Aztec mill, which at that time consisted of 40 stamps, was remodeled to treat ore by cyanidation as well as by amalgamation and concentration, and by 1911 the lode mines of the district were again producing. In 1914 a bonanza was found in the Aztec mine, and production rose from $63,129 in 1914 to $350,745 in 1915 and $417,258 in 1916. In the 10-year period from 1911 to 1920, production was $1,826,989.

---

[12] Lee, work cited. p. 325.

Production

The following table shows the production of the Mt. Baldy, Elizabethtown, Therma district from 1909 to 1935:

Year	Placer	Lode
Prior to 1909[1]	$2,250,000	$1,250,000
1909	16,037	1,705
1910	9,583	3,433
1911	9,860	31,547
1912	8,385	27,316
1913	4,550	15,588
1914	4,930	63,129
1915	2,631	350,745
1916	5,039	417,258
1917	5,739	342,994
1918	2,133	258,034
1919	3,885	238,656
1920	1,634	81,722
1921	3,447	5,361
1922	1,472	76,341
1923	1,811	48,725
1924	2,303	242
1925	970	51,688
1926	1,851	18,745
1927	2,155	32,962
1928	424	18,052
1929	—	—
1930	—	248
1931	103	—
1932	2,430	2,610
1933	1,980	5,196
1934	3,600	36,447
1935	6,220	74,871
Total	2,353,177	3,453,615

---

[1] Estimated.

Aztec Mine

Recent History

In 1923 the old mill on the Aztec property and a new one that was just completed were destroyed by fire. Another mill was built immediately, and in 1926 it was remodeled. The plant, as remodeled, was of 50-ton daily capacity and consisted of a Universal crusher, 2 Chilian mills, 4 amalgamation plates, 1 cone classifier, 2 Wilfley tables, 2 flotation machines, and 1 Dorr thickening tank. The property belongs to the Maxwell Land Grant Co.

The mine was shut down from 1929 to 1934. In 1932 and 1933 lessees operated the mill on dump ore, and gold was recovered in the form of amalgam and bullion.

In 1934 the mine was reopened and the lessees did development work and opened up enough ore to maintain a steady production of bullion and concentrates. In October 1935 the flow-sheet was changed to flotation. The capacity of the new mill now is 30 tons per 24 hours.

The ore contains free gold and sulphides and arsenides of silver and copper in a gangue of calcite and shale.

Present activities

At present (1936) 60 men are employed by the Maxwell Land Grant Co. doing development and exploration work. Power is supplied by Diesel engines. It is reported that there is some production that is being treated in the flotation mill, but the project is still in the development stage. Most of the work is being done in the Aztec mine, although a number of other mines in the district are on the grant.

The Maxwell Land Grant Co. is owned by interests in Amsterdam, Holland. J. van Houten, of Raton, N. Mex., is the United States agent and attorney.

Montezuma Mine

The Montezuma mine belongs to the Maxwell Land Grant Co. It was reopened in 1933 by lessees. The ore is treated in a small amalgamation and concentration mill at the mine. The concentrates are shipped to the Golden Cycle mill in Colorado Springs and the bullion to the United States mint at Denver.

Rebel Chief Mine

Production was started at the Rebel Chief in 1934. Small amounts of soft muddy ore are treated in a hand washer. Hand sorted high-grade ore is ground in a hand mortar before treatment.

Red Bandana Mine

The Red Bandana is privately owned and operated. Small lots of crude ore were shipped to the Golden Cycle mill in Colorado Springs in 1934. Since 1935 the ore was ground in a small Huntington mill and run over copper amalgam plates.

Ajax Mine

In 1935 the Ajax Mining Co. shipped 200 tons of gold ore containing 207 ounces of gold to the Golden Cycle mill at Colorado Springs from the Golden Ajax mine on Willow Creek.

Placer Mines

In 1935 the production from placers was $6,220. Most of this was from hydraulicking operations and drift mining on South Ponil, Ute, and Willow Creeks.

During 1935 a testing operation was carried on by the New Mexico Gold Producers Corporation on its lease from the Maxwell Land Grant Co. One hundred forty-six thousand yards of material were handled by a dragline excavator and treated in a flotation and washing plant. The experiment was unsuccessful.

LINCOLN COUNTY

Situation and Facilities

Lincoln County is in approximately the center of New Mexico, 75 to 100 miles east of the Rio Grande River. The southwestern part of the county is rugged and mountainous. The Jicarilla, Captain, Tres Cerro, White, Mescolero, and Sacramento Mountains form a range that extends south through Otero County to the Texas State line.

The county is served by two U. S. highways. U. S. No. 71, in the western part of the county, runs north and south from Corona, in Lincoln County, to Alamogordo, in Otero County. The one in the southern part of the county, U. S. No. 47 and 49, runs east and west from Roswell, in Chavez County, to Carrizozo, in Lincoln County.

History

The gold production of the county was never very impressive. The largest annual production was in 1914, when 3,060 ounces was produced. A number of lode mines were developed, and mills were built to treat the ore, but very few of these ventures were successful. Placer mining accounted for a substantial but minor proportion of the total production.

The Homestake mine of the White Oaks district was the largest and steadiest producer in the county. The property was taken over by the Wild Cat Leasing Co. in 1906 or 1907 and put into production. The ore was milled in a 20-stamp amalgamation mill. For many years it was the principal producing mine of the county. In 1915, the White Oaks Mines, Consolidated, acquired ownership. Production fell to less than half of what it had been up to that time, but it was kept going until 1921, when it was shut down.

Other old mines in the county are the Murphy group in the Jicarilla district, and the Parsons, Hopeful, and American mines in the Nogal district. The Murphy group was operated by the Wisconsin Mining and Smelting Co. from about 1906 until 1910. In 1908 and 1909 large tonnages were treated in a 40-ton amalgamation mill. The Parsons, Hopeful, and American mines were operated by the Parsons Mining Co. in 1914, 1915, 1916, and 1917. A 250-ton cyanide mill was completed in 1917, but little if any ore was ever treate

Most of the placer gold from the county came from the Jicarilla district. It furnished a small but steady output up until 1925, when gold production in Lincoln County ceased entirely, and did not revive until 1932. Gold production from 1932 to 1935 was as follows:

	Ounces
1932...............	478
1933...............	703
1934...............	1,042
1935...............	893

The present gold production of Lincoln County is almost entirely from the Jicarilla, the Nogal, and the White Oaks districts.

Jicarilla District

The Jicarilla district is near the south end of the Jicarilla Mountains. The village of Jicarilla is the nearest settlement. It is a few miles to the southwest of the district and has a population of about 275. The district is served by a branch highway running from Ancho, on U. S. Highway 71, southeast to Captain, on U. S. Highway 47.

Production is mostly from placers. In 1933, 50 tons of ore was shipped to the smelter at El Paso and 80 was treated in a 10-ton amalgamation plant at the Lucky Strike mine. The amalgamation equipment at this mine was moved out of the district later.

Placer operations consist of panning, sluicing, hand rocking, and work with Ainlay bowls. Most of the recovered gold is sold to local dealers in Ancho and Carrizozo but some is sent directly to the Denver Mint. In 1935 a power shovel and other equipment for large-scale operations was moved into the district, but it was operated for only a short time.

Nogal District

The Nogal district is on U. S. Highway No. 47, 13 miles east of Carrizozo. Nogal, the nearest settlement, has a population of about 200.

The Helen Rae mine is the principal producer of this district. This mine was first mentioned in the Minerals Yearbook in 1920. From that year until about 1925 considerable development work was done but only occasional shipments of bullion or concentrates were made. The mine is operated by the Helen Rae Mining Co. Shipments of bullion were sent to the Denver Mint every year since 1932. The ore is treated in a small amalgamation mill consisting of a small crusher and a Huntington mill. Other production is from small-scale placer operations.

White Oaks District

The White Oaks district is approximately on a straight line from the Nogal to the Jicarilla district and about half way between. It is about 8 miles east of U. S. Highway No. 71 and is served by a branch highway running southwest from the village of Jicarilla and joining highway No. 71 just southwest of the district. The village of White Oaks, with a population of about 100, is the nearest settlement.

The El Aviador Gold Mining Co., operating the Smuggler and Little Nell mines, is the principal producer. Some of the ore is shipped to the smelter at El Paso and some is treated in an amalgamation concentration mill of 15 tons daily capacity at the Little Mack mine. In 1935, 612 tons of ore containing 279 ounces of gold and 153 ounces of silver was shipped to El Paso, and 117 tons was treated at the amalgamation mill, yielding 93 ounces of bullion 835 fine.

SOCORRO COUNTY

Production

Gold production of Socorro County is principally from the San Mateo Mountains, the Silver Hills district, and the Rosedale district. From 1917 until 1934 the total annual gold production of the county was negligible; in 1934 it was 161 ounces and in 1935, 550 ounces.

Magdalena District

The Magdalena district produced small amounts of gold from lead, zinc, and copper ores. From 1913 to 1917 the production from this source was from 100 to 200 ounces a year, but since then it has never been more than 5 to 10 ounces a year, except in 1925, when it was about 55 ounces. In 1932 the Kelley Magdalena mine of the Empire Zinc Co. made shipments of lead-zinc ore containing gold and silver. Since then the production of the district has been negligible.

Silver Hills District

Production from the Silver Hills district is mostly from test runs made at a testing plant of 25-ton daily capacity. This plant was started in 1933 and used flotation. It continued operating in 1933 and 1934, but in 1935 flotation was replaced by a 20-mesh screen and a sand table and tailing launders lined with cotton blankets. Production in 1935 was 243 pounds of concentrates containing 2.30 ounces of gold.

San Mateo Mountains

In 1934 the Springtime Mining Co. and T. B. Everhart began making shipments from the San Mateo Mountains. Both of these operators shipped from newly developed claims. In 1935 the Springtime Mining Co. completed a flotation mill of 40 tons daily capacity and treated 1,295 tons of ore from the Panky mine. The concentrates produced contained 280 ounces gold and 4,800 ounces silver. Development in the mine consists of an adit 600 feet long and a shaft 100 feet deep with levels at 50 and 100 feet from the collar. Other operators produced a 35-ton shipment of gold-silver ore that was sent to El Paso.

Rosedale Gold Mines Limited

Situation

Rosedale gold mine is situated on the northeastern slope of the San Mateo Mountains in the County of Socorro, New Mexico. The nearest town is Magdalena, on the Santa Fe Railroad, from which point a first-class gravel road runs 29 miles southwest to the mine. The mine is at an elevation of 7,500 feet in the heart of a pine forest, and the camp enjoys an exceptionally temperate climate.

History[13]

Gold was discovered in the San Mateo area about 1882, and the Rosedale property was operated almost continuously from 1886 to 1911. Reports state that dividends were paid for about 15 years simply from ore taken from development. The property was reopened in 1913 and ran until 1916, when a fire destroyed the mill and surface plant. No data are available as to actual production, but it is evident that during early days the mine produced several hundred thousand dollars worth of gold.

In 1934 the present operators obtained the property, reconditioned the mine, and erected a complete cyanide plant of 65-ton daily capacity. After various test runs, the plant went into steady operation in November 1935 and was operated continuously until November 1936, when it was shut down for 3-1/2 months to permit enlargement of the power plant, increase in the mill capacity, and straightening one or two reverse bends in the main shaft. Early in March 1937 the plant resumed production, and at present the mill is treating 135 tons of mine ore daily.

Topography and geology

The San Mateo Mountains cover an area of some 800 square miles, extending for about 45 miles in a southwesterly direction. The rocks of these mountains are an accumulation of volcanics, chiefly rhyolite flows. No sediments occur, except in the southern part of the range at Nogal Creek, where a patch of Magdalena limestone (Pennsylvanian age) is reported.

The rhyolite in the Rosedale area is of Tertiary age and the district is remarkably free from dykes or other types of intrusives.

---

[13] Lasky, Samuel G., The Ore Deposits of Socorro County, New Mexico: New Mexico Bureau of Mines Bull. 8, 1932, pp. 94-95.

The Rosedale vein occurs in a prominent shear zone in a hard rhyolite prophyry. This shear is a main structural feature in the area and can be traced for at least a mile to the southeast of the shaft and for a similar distance to the northwest, as the hard porphyry forming the wall rock of the vein withstands weathering action to form rugged ridges on the slopes and along the backs of the hills. The shear containing the vein has an average strike of N. 15 W. and a dip of 75° to 85° to the southwest.

The shearing extends for a considerable distance into the wall rocks, and for this reason the vein walls are loose in many places and not well defined. The vein filling is mostly a white quartz, crushed and broken portions of rhyolite recemented by quartz to form a type of rhyolite breccia, some limonite, a little hematite, and in places much manganese, which occurs as a black film on the fractures. The gold is free and is found as minute films on the quartz and rhyolite fragments. Usually, where the vein is rich, a considerable quantity of greenish quartz is present, which has a waxlike luster, and this type of quartz is one of the markers for high-grade ore. Oxidation has been intense and extends to the 700 level at least. No sulphides have ever been detected, and although water is present immediately below the 700-level station, it seems likely that the oxidation zone will extend to a much greater depth.

The gold values are spotty. Ordinarily, the values will lie in a high-grade streak; at times a rhyolite breccia band may carry the values, and again a streak of banded quartz may carry high gold values. Such streaks cannot be relied upon to carry for any great distance, as the high-grade portion may suddenly jump from one wall to the opposite side. It is possible and very probable that as the mine is deepened, and especially as the bottom of the oxidation zone is reached, the vein values will be more consistent.

Some premineral faulting is evident, but it is due to the great amount of post-mineral faulting that the ore zones have been cut into blocks and moved considerable distances. Considerable geologic study is being given to the vein structure, throw of faults, etc., but a great additional amount of such work must be done before a complete story can be written as to the movements of the Rosedale vein. Briefly, one or more major post-mineral faults has shifted the vein to the south and at the same time depressed or forced the ore blocks downward. In places, large ore blocks may be found in the heart of such fault movement, but it appears that the larger ore zones are outside the areas of greatest fault disturbance. The faulting has caused a thickening and thinning of the vein, and where thickening occurs the better grade ore is found. Ore blocks will average 100 to 150 feet in length and 100 to 200 feet in height, and in such areas the vein will average 5 to 15 feet in width.

In many places the vein walls are not well defined and the ore is mined to an assay wall.

Development

The mine was opened by a 2-compartment shaft sunk on the footwall of the vein to a depth of 726 feet. When the mine was first worked, levels were driven north and south from the shaft in the vein at 50-foot intervals. For present operations, the level interval has been increased to 100 feet.

Prospecting

The ore zones are prospected by driving drifts and crosscuts, then blocked out between the levels by means of 2-compartment raises driven 100 to 150 feet apart. Such raises afterwards serve as entrance to the stopes and provide proper ventilation to the stoping areas.

Mining methods

The 2-compartment raises have an untimbered chute compartment and a manway compartment closely cribbed with 3- by 12-inch cribbing 4 feet long. The manways have a timber slide for lowering drill steel and supplies to the stopes, a ladderway, and air and pipe lines.

Two men - a miner and a helper - are used in driving raises.

Drifts are driven 5 by 7 feet in the clear, no timber being required. On drift work, one man operates a rock drill, a second man being required only to aid in blasting.

Each level block between the completed raises is prepared for stoping by installing chutes at 15-foot intervals with rock pillars between. The first round for each chute pocket is blasted on the track. The 6- by 8-inch chute timbers are then put in place and a chute of 3-inch lagging is built. Light rounds are then drilled and blasted into the chute. The chute pockets above the chutes are enlarged until they are connected, leaving a pillar from 8 to 10 feet thick between the chutes and a level back 20 feet above the rail from which to start stoping.

This practice has proved to be fast and safe and it does not tie up a level with large piles of muck on the track.

Practically all stoping is by the shrinkage method. Excessive dilution from loose wall rock is prevented by keeping the stopes as full as possible while breaking is in progress. Each cut or slice is carried the full length of the stope before the next one is started, thus preventing the exposure of more than 10 feet of wall rock between the top of the broken ore and the back of the stope. The ore does not tend to break in large pieces. Close attention is given to the placing and loading of drill holes; hence, very little chute blasting is necessary and very few boulders are sledged on the level grizzlies. Breakage in the stopes averages 49.3 tons per machine shift.

An 8-foot pillar is left between the back of the stope and the level above. After a stope is finished, the air and water lines are removed from the raises.

When drawing a stope, the top of the ore pile is kept level by close drawing control. This prevents further dilution while the broken ore is being extracted. Loose rock from the walls falls on top of the broken ore and does not appear in the chute until after a large percentage of the ore has been extracted.

Very few pillars are mined after the stopes are once finished. Waste from development is used as filling in old stopes; however, stope refilling is unnecessary, as not enough ground has been opened up to cause rock movement.

The ore is hand-trammed in 16-cubic-foot standard box-type mine cars and dumped into shaft pockets over 8-inch grizzlies. The skip tender loads from hand-operated chutes to a 1-ton skip cartridge, which discharges direct into a 1-ton skip. The skip dumps automatically into the headframe ore bin.

Worthington 86 drifters mounted on 3-inch columns are used in all drifts, crosscuts, and stopes. Stoping machines are used in the raises. One-inch, round, hollow-lugged steel is used in the drifters and 1-inch, hollow, quarter-octagon steel in the stopers.

One- and one-eighth-inch 40-percent gelatin is used in all cut holes in the drifts and raises. All other holes are blasted with 1-1/8-inch Gelex powder.

Channel samples are taken from every face after each blast in order to maintain close control on vein values. The engineer supervises all sampling and development work and has charge of all mine records.

All timber is cut to standard size in the mine timber yard. Native-pine timber is used throughout the mine.

The mine is cool and there is no dust. There is no water above the 700 level. Good ventilation is maintained in all working places. All working-shaft stations and ore-loading stations are electrically lighted. Mine refuse is removed from the mine daily.

The mine operates two 8-hour shifts for 6 days a week. On Sunday, usually one haulage and hoisting shift is required to maintain sufficient ore for the mill. The mine employs only white labor of the highest-skilled type. Lately, due to the country-wide shortage of skilled labor, it has been necessary to train a number of local men. Many of these men are turning into first-class machinemen and miners, although they had never worked underground before.

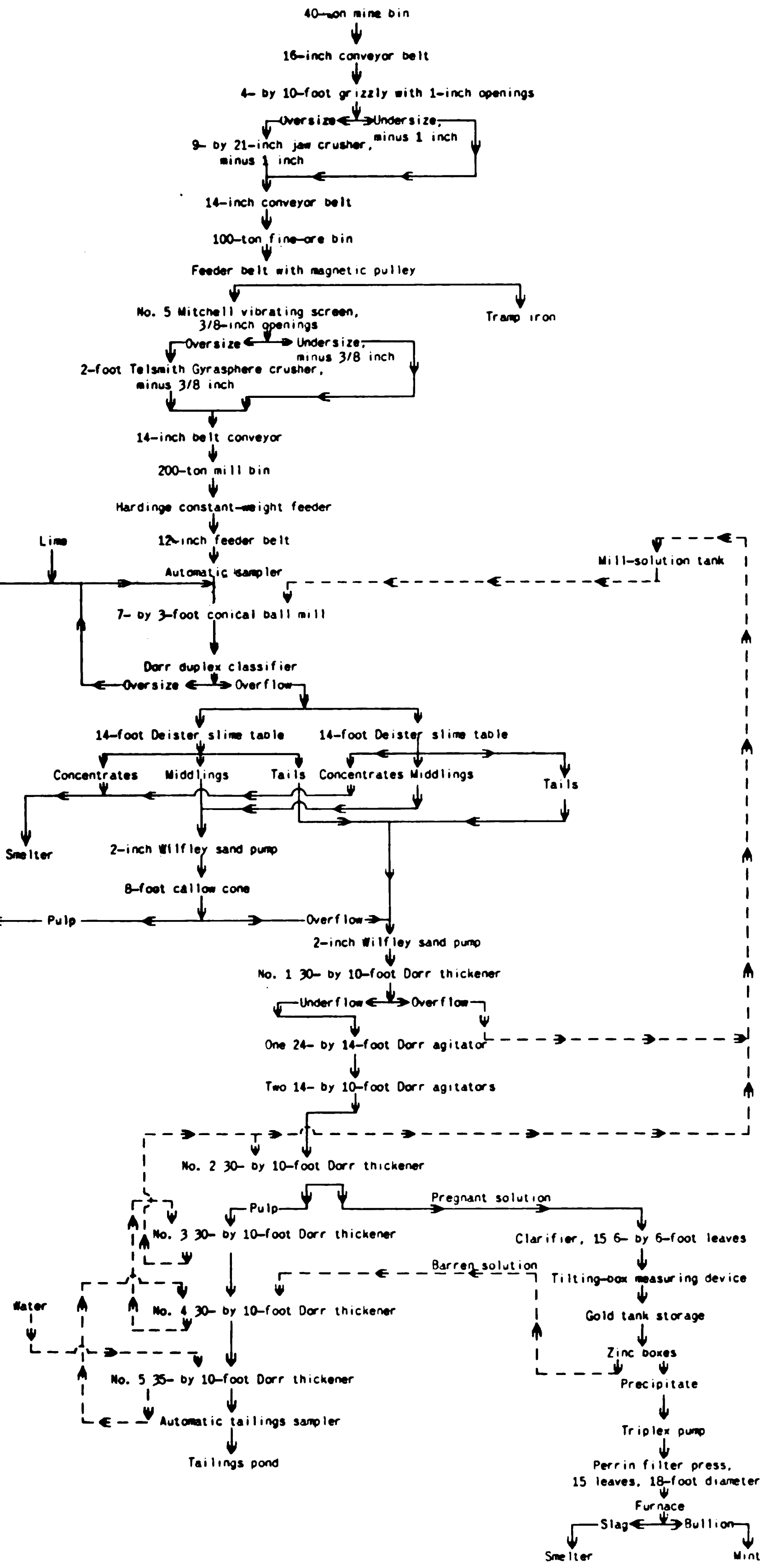

40-ton mine bin
16-inch conveyor belt
4- by 10-foot grizzly with 1-inch openings
Oversize
Undersize, minus 1 inch
9- by 21-inch jaw crusher, minus 1 inch
14-inch conveyor belt
100-ton fine-ore bin
Feeder belt with magnetic pulley
No. 5 Mitchell vibrating screen, 3/8-inch openings
Tramp iron
Oversize
Undersize, minus 3/8 inch
2-foot Telsmith Gyrasphere crusher, minus 3/8 inch
14-inch belt conveyor
200-ton mill bin
Hardinge constant-weight feeder
12-inch feeder belt
Lime
Automatic sampler
Mill-solution tank
7- by 3-foot conical ball mill
Dorr duplex classifier
Oversize
Overflow
14-foot Deister slime table
14-foot Deister slime table
Concentrates
Middlings
Tails
Concentrates
Middlings
Tails
Smelter
2-inch Wilfley sand pump
8-foot callow cone
Pulp
Overflow
2-inch Wilfley sand pump
No. 1 30- by 10-foot Dorr thickener
Underflow
Overflow
One 24- by 14-foot Dorr agitator
Two 14- by 10-foot Dorr agitators
No. 2 30- by 10-foot Dorr thickener
Pulp
Pregnant solution
No. 3 30- by 10-foot Dorr thickener
Clarifier, 15 6- by 6-foot leaves
Barren solution
Tilting-box measuring device
Water
No. 4 30- by 10-foot Dorr thickener
Gold tank storage
Zinc boxes
Precipitate
No. 5 35- by 10-foot Dorr thickener
Automatic tailings sampler
Triplex pump
Tailings pond
Perrin filter press, 15 leaves, 18-foot diameter
Furnace
Slag
Bullion
Smelter
Mint

Figure 11.- Flow sheet of Rosedale Gold Mines, Ltd., mill.

During the last three months bonus and contract systems have been introduced. Drifts and raises are run on a contract basis at a published price per foot of advance. Powder, caps, and fuse are sold to the contractors at cost price.

Stopes are bonused on a certain price per cubic yard of extraction. Bonus rates may be changed as conditions demand, but new rates are posted at least a week before the end of each period. Stopes are measured at least twice a month by the mine engineer, and bonus and contract sheets are posted before the following pay day. All miners, trammers, and muckers on bonus or contract are guaranteed the regular rate of daily pay for the type of work performed. A total of 23 men is employed on the mine force, which includes foremen, miners, trammers, muckers, and hoistmen.

Underground men wear the usual type safety hats. Safety kits are maintained on all levels and safety rules are rigidly enforced at all times. Since July 1935, when the first underground work commenced, there have been no serious accidents in the mine and only a few accidents of a minor nature, such as cut fingers, etc.

Milling

Figure 11 is a flow sheet of the Rosedale mill.

Ore from the 40-ton head-frame bin is fed directly to a 16-inch conveyor belt, discharging over grizzlies with 1-inch openings to a 9- by 21-inch Telsmith jaw crusher set to 1-inch opening. The undersize from the grizzly and the discharge from the crusher feed onto a 14-inch conveyor belt, which feeds to a 100-ton fine-ore bin. Ore from the fine-ore bin discharges onto a feeder belt equipped with a Dings magnetic pulley to remove tramp iron, and thence onto a No. 5 Mitchell vibrating screen with 3/8-inch openings. The oversize from the vibrating screen feeds direct to a 2-foot Telsmith Gyrasphere crusher, which crushes to minus 3/8 inch. The screen undersize and gyrasphere discharge fall on to a 14-inch conveyor belt discharging into a 200-ton mill bin. Provision has been made to close-circuit the gyrasphere crusher and the vibrating screen, but, due to the nature of the rock, little oversize is produced and this installation probably will not be installed until a step-up in tonnage is made.

The ore from the mill bin is fed by a Hardinge constant-weight feeder to a conveyor belt, thence to a 7-foot by 36-inch Hardinge ball mill running in closed circuit with a Dorr duplex classifier. The mill head sample is cut at the point where the feed enters the ball mill by means of an automatic sample cutter, which cuts the entire stream for a portion of the time. This sample falls into a separate bin. Grinding is done in cyanide solution and approximately 55 percent of the gold is dissolved in the ball-mill circuit. Lime is also added in the ball mill from a separate lime tank situated outside the mill building.

Forged steel grinding balls are used. Rosedale ore is extremely abrasive and the liner and ball wear is high. The mill is lined with manganese steel liners, yet a set of liners will grind only about 16,000 tons. A mixture of 25-percent 3-inch and 75-percent 2-inch balls is used. Ball consumption runs 4-1/4 to 4-1/2 pounds per ton of ore. The ball-mill discharge runs at 80-percent density and the classifier overflow 19- to 20-percent density.

The classifier overflow goes to two Deister slime tables. The tables make three products - a concentrate that contains about 10 percent of the total gold produced and sent to the smelter; a middling that is pumped to an 8-foot Callow type cone; and a tailing that constitutes the feed to the cyanide section. The cone overflow joins the table tails to the cyanide tanks, and the spigot discharge is returned direct to the ball mill. Before installing the cone, the table middlings were pumped direct to the classifier, but trouble was experienced, inasmuch as too much water was added to the classifier and a great amount of material ground fine enough for cyaniding polluted the ball-mill circuit. The feed to the cyanide section averages as follows:

	Percent
+ 100 mesh........	9
- 100 + 200.......	26
- 200.............	65

The table tails are pumped to a 30- by 10-foot Dorr thickener, the overflow is sent to the mill solution tanks, and the underflow to the agitators. The pulp passes through a set of three agitators, thence through a unit of four tanks operated in counter current.

Pregnant gold solution overflows from the tank following the agitators to a vacuum clarifier, thence to a head gold tank, and then through the zinc boxes. Every third day the zinc boxes are cleaned, the sludge being flushed to a triplex pump and pumped direct to a small locked Perrin press. Zinc shavings are cut in the mill on a zinc lathe from zinc sheets purchased direct from rolling mills. The cake in the Perrin press is air-dried, discharged direct into pans, and carried to the smelter, where it is melted into bullion.

Reagent consumption per ton of dried ore is as follows:

	Pounds
Lime............	2.87
Cyanide.........	.50
Zinc............	.44

Once each month the mill is shut down for 12 to 16 hours for repairs and inspection. Operating time averages 96 percent.

The mill heads average only a fraction of an ounce in silver and 0.12 ounce per ton in gold. Mill extractions are computed daily. The average recovery is from 90 to 92 percent.

The mill operates three 8-hour shifts 30 days a month. American labor is employed everywhere except in the crushing section. The mill crew consists of 1 mill foreman, 3 operators, 3 mill helpers and 2 crushermen.

Power plant

Generating equipment consists of two Diesel engines direct-connected to 480-volt generators and having a total output of 365 horsepower. The power plant also includes a 14-1/2- by 8- by 10-inch direct-driven Worthington compressor that supplies air for the mine, and a small, single-stage, Sullivan compressor that supplies low-pressure air for the mill agitators.

Shops

A fully equipped machine shop is maintained on the property. Electric welding equipment as well as oxygen acetylene equipment is maintained, and all repairs except heavy Diesel repairs are made on the property under the direction of a machinist and an electrician.

The steel-sharpening shop is equipped with the usual machines. A fully equipped assay office is run for the proper guidance of the mine and mill operation.

Housing

A bunk house and boarding house are operated for unmarried employees and small residences are provided rent-free for married employees. All residences are electrically lighted and most of the houses are provided with running water. The company employs 48 men, all of whom are housed at the property.

Costs

Detailed costs of all operations are kept at the office. Each day, at noon, the total detailed costs for the previous day and the month-to-date costs are posted. Total operating costs, mine, mill, office, etc., average $2.50 to $2.60 per ton of ore milled.

OTERO COUNTY

The entire gold production of Otero County comes from the Oro Grande district, mostly from placers. In 1934 the owner of the Flying Eagle lode claim did some development work and produced 340 tons of ore averaging 0.10 ounce gold, 5 ounces silver, and 42 percent lead. The ore was not shipped in 1934. The Oro Grande Placer Syndicate is working the Little Joe and Cotton Top placers and has been making regular shipments to the Denver Mint. Individual operators working intermittently at the Center placer, 2-1/2 miles northeast of Oro Grande, recover small amounts with a two-way dry washer run by a gasoline engine.

SANTA FE COUNTY

Production from Santa Fe County is from the Los Cerrillos and Golden or San Pedro districts. Some of the production from the Los Cerrillos district is from lode mines but most of it is from placers. Lessees at the Santa Fe mine in the San Pedro district produce small amounts of gold ore that they treat by amalgamation in a 6-foot Huntington mill; bullion is sent to the mint in Denver. Other small operators just east of the village of Golden ship small amounts of crude ore to the El Paso smelter.

GOLD PRODUCTION OF BASE METAL MINES

GENERAL

Up to 1934 over 75 percent of the total gold production of New Mexico was from base-metal mines that produced complex ores containing copper, lead, zinc, gold, and silver. In 1934 the production from base-metal mines was 68-1/2 percent of the total, but in 1935 it was only 52.6 percent of the total.

TERERRO DISTRICT

Pecos Mine of the American Metal Co.

Situation and General

The mine is at Tererro in the western part of San Miguel County on the Pecos River at an altitude of 8,000 feet. It is 17 miles northeast of Santa Fe, the capital of New Mexico, and 14 miles north of Glorieta, the nearest railroad station on the main line of the Atchison, Topeka, and Santa Fe Railroad. A 4-1/2-mile standard-gage spur runs from Glorieta to Alamitos, where the mill is situated. The ore is transported from the mine to the mill over an aerial tramway 12 miles long. There is a good automobile road from the mine to Pecos on U. S. Highway 85.

For many years this mine has been the largest producer of gold in New Mexico. It reached its peak production in 1933, when it produced 19,424 fine ounces, or 73-1/2 percent of the total production of the State. In 1934 production was 15,632 fine ounces, 57.3 percent of the total, and in 1935, 14,816 fine ounces, 44.4 percent of the total.

Geology[14]

The mine is in pre-Cambrian granite overlaid by limestone of carboniferous age. The ore bodies are in a northeast-southwest shear zone from a few feet to several hundred feet thick. The mineralization consists of a mixture of sphalerite, galena, chalcopyrite, and pyrite carrying appreciable amounts of gold and silver.

The ore bodies have been developed for a distance of 2,000 feet along the strike of the shear zone and to a depth of 1,200 feet. They are roughly lenticular in shape and sometimes pinch out abruptly either horizontally or vertically. The lenses usually are disconnected, but the ends often overlap.

Development

The mine is opened by two shafts and two adits. The main shaft is vertical and has four compartments with levels at 100-foot intervals. The bottom of this shaft is 50 feet below the 1,000-foot level. The Evangeline shaft was sunk before the present owners started operating the mine. The old development was done from this shaft. It is a vertical two-compartment shaft about 1,000 feet northeast of the main shaft and is used for handling men and supplies.

Mining Methods[15]

The ore bodies consist of one to four parallel veins separated by bands of soft schist and blocky diorite. Sometimes the veins can be mined separately, but more often the composite mass must be mined and the waste sorted out. The walls of the stope do not hold up and filling must be done as the ore is mined out. In wide stopes the back is held up by temporary pillars of cribbing built from the top of the fill to the back of the stope. The waste is sorted from the ore and left as filling in the stope while the ore is run through cribbed ore passes to chutes in the drifts below. Raises from the back of the stope to the level above are used for running in waste filling, as the waste sorted from the ore is not usually enough to fill the stope completely. Cut-and-fill and square-set-and-fill methods are used. Pillar mining by underhand stoping, similar to the method used at the Magma mine[16] at Superior, Ariz., has been used successfully with a cost slightly less than square-set-and-fill. The method has not been put into general use because of the close supervision required. Normal production of the mine is 600 tons a day.

---

[14] Matson, J. T., and Hoag, C., Mining Practice at the Pecos Mine of the American Metal Co. of New Mexico: Inf. Circ. 6368, Bureau of Mines, September 1930.

[15] Matson and Hoag, work cited.

The mine makes considerable water, due to the proximity of the ore body to the Pecos River and Willow Creek. Sufficient drainage must be provided before a stope can be started. Total underground-mining cost for 1927, 1928, and 1929, including prospecting and developing, was $4.379 per ton.

Milling[17]

The ore is transported from the mine to the mill at Alamitos over an aerial tramway 12 miles long. At the mill, it is treated by selective flotation methods making a lead concentrate and a zinc concentrate.

A typical analysis of mill heads is gold 0.10 ounce per ton, silver 3.3 ounces per ton, lead 4.9 percent, copper 0.8 percent, and zinc 15.4 percent. Metallurgical results for the year 1930 show that 77 percent of the gold was recovered in the lead concentrate, 8 percent in the zinc concentrate, and 15 percent was lost in the tails. Of the silver, 63 percent was recovered in the lead concentrate, 22 percent in the zinc concentrate, and 15 percent was lost in the tails.

The milling cost for 1930 was $1.069 per ton exclusive of laboratory, experimental work, and royalties, which were $0.120 per ton, making a total milling cost of $1.189 per ton.

LORDSBURG DISTRICT

Situation and Facilities

The Lordsburg district, including the Virginia and Pyramid or Shakespeare districts, is south of Lordsburg in the Pyramid Mountains in Hidalgo County about 20 miles by road east of the New Mexico-Arizona State line at an altitude of 4,237 feet. It is on the main line of the Southern Pacific Railway and also on U. S. Highway 80, which is paved all the way east to El Paso and west to within a few miles of the Arizona State line. U. S. Highway 180, which is also paved, runs northwest from Lordsburg to Duncan, Ariz.

---

[16] Snow, Fred W., Mining Methods and Costs at the Magma Mine, Superior, Ariz.: Inf. Circ. 6168, Bureau of Mines, September 1929.

[17] Bemis, H. D., Milling Methods and Costs at the Pecos Concentrator of the American Metal Co., Tererro, N. Mex.: Inf. Circ. 6605, Bureau of Mines, May 1932.

Production

Up to 1931, the Lordsburg district had been a very important producer of gold. In 1929, 1930, and 1931 the production of Hidalgo County was 10,008 ounces, 14,012 ounces, and 11,278 ounces, respectively. At least 90 percent of this was from the Lordsburg district, where the Eighty-Five mine,[18] of the Phelps-Dodge Corporation, was the principal producer.

Eighty-Five Mine

Early in 1932, the Eighty-Five mine was shut down and the gold production of Hidalgo County dropped to 1,412 ounces. In 1933 the production was only 111 ounces, but during the two years that followed a number of small operators started producing, and in 1935 the production was 993 ounces.

Geology

The rocks of the Pyramid Mountains consist of andesite, diorites, and porphyries of similar composition intruded by coarse-grained light-colored granodiorite. The ore deposits are in fissure veins. The ore minerals consist of chalcopyrite and pyrite carrying gold and silver. The gangue minerals in the veins are quartz, calcite, barite, hematite, and rhodocrosite.

Mining methods

Mining at the Eighty-Five mine[19] was by shrinkage and inclined cut-and-fill. If the walls were solid, shrinkage was used. If the walls were loose or if a great deal of waste had to be broken, the inclined cut-and-fill system was used. From 1920 to 1930, 72 percent of the total ore mined was by shrinkage and 28 percent by cut-and-fill methods. Ore that was mined by shrinkage was sorted before it was loaded into railroad cars. Some of the ore that was mined by cut-and-fill methods was shipped without sorting.

The entire output of the mine was shipped in the crude state to the Douglas smelter of the Calumet and Arizona Mining Co. From May 1, 1920, to June 1, 1930, 783,138 tons were shipped. This ore averaged 0.111 ounce gold, 1.23 ounces silver, and 2.79 percent copper.

---

[18] Youtz, R. B., Mining Methods at the Eighty-Five Mine, Calumet and Arizona Mining Co., Valedon, N. Mex.: Inf. Circ. 6413, Bureau of Mines, March 1931.

[19] Youtz, work cited.